03

TECHNICAL MEMORANDUM NUMBER 1

DATE: January 16, 1991

TO: Vanessa Harris, Site Manager

CC: Marcia Kuehl - RI Lead
Roman Gau - Project Manager
Mike Crosser - TSQAM

FROM: Tom Puchalski

PRELIMINARY

SUBJECT: EPA ARCS Region V Contract No. 68-W8-0093
EPA Work Assignment No. 17-5L4J
Donohue Project No. 20026.023
Himco Dump RI/FS

MONITORING WELL INSTALLATION

Introduction

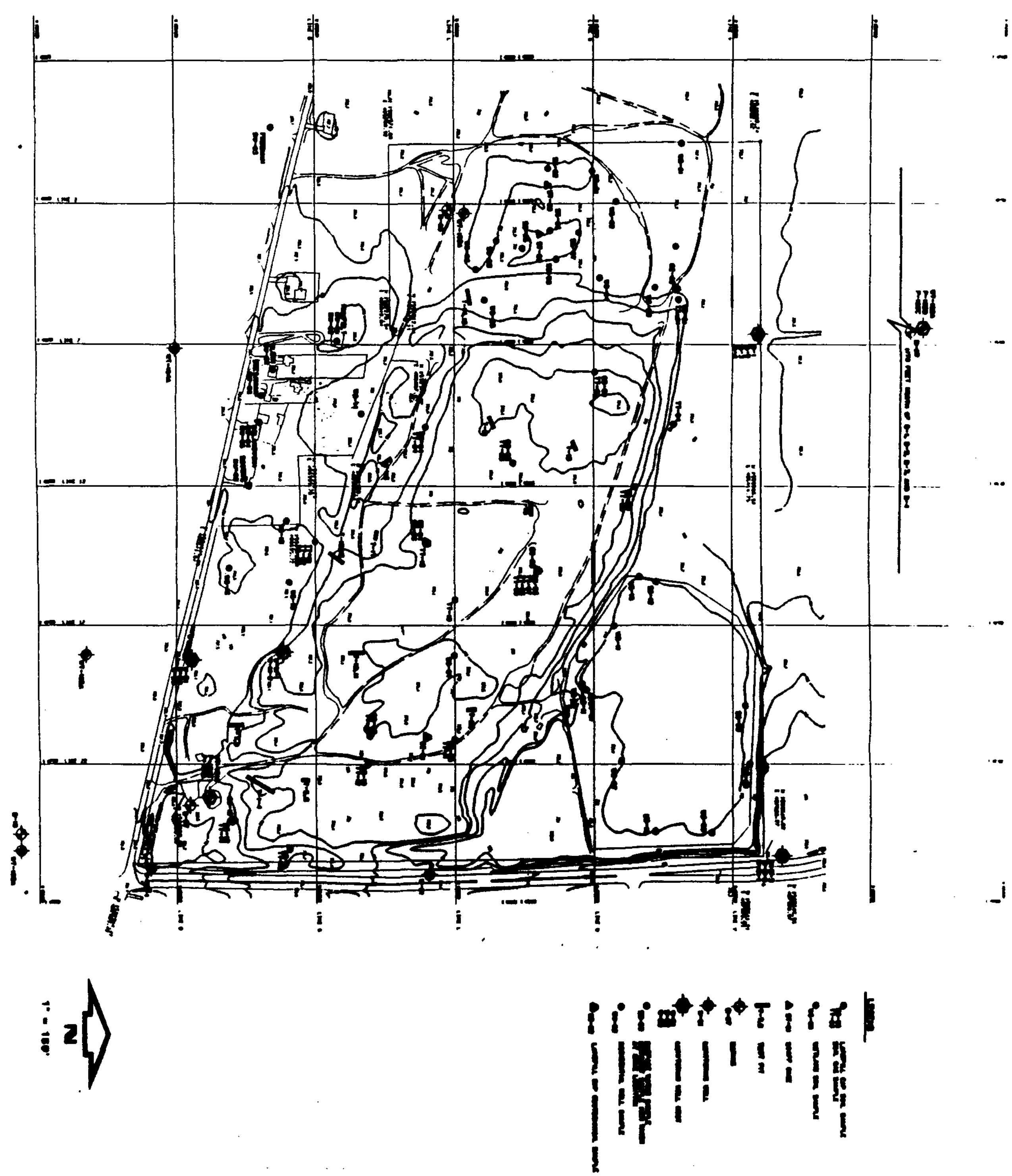
Four deep groundwater monitoring wells were installed as described in Exhibit A, Field Sampling Plan Addendum to Volume 2, Field Sampling Plan, Himco Dump Remedial Investigation/Feasibility Study, Elkhart, Indiana. Drilling activities for these well installations began on November 27, 1990, and were completed December 15, 1990. These piezometers were installed to provide groundwater samples for chemical analysis and ~~to provide~~ water elevations to be used in groundwater flow analysis. Steve Padovani and Tom Puchalski of Donohue & Associates, Inc., inspected the drilling and well installation activities, completed qualitative logs based upon visual inspection of cuttings liberated during air rotary drilling, performed and documented air monitoring using a photoionization detector and gasponder, and completed well installation documentation forms and activity logs. Drilling and well installations were completed by John Mathes and Associates, Inc. (Columbia, Illinois), with a TH 60, Ingersol Rand air rotary rig.

Methods

Drilling and well installation methods were performed as described in Exhibit A, Field Sampling Plan Addendum to Volume 2, Field Sampling Plan, Himco Dump Remedial Investigation/Feasibility Study, Elkhart, Indiana, Section 4.2.

Air rotary drilling was used to advance boreholes prior to the installation of piezometers. A 7-7/8-inch tricone bit was advanced ahead of 8-inch driven steel casing. No samples were retained from these four borings for piezometer installations, but the Donohue geologist completed an approximate log as drilling progressed based upon visual inspection of drill cuttings.

Piezometers were finished at the following depths: P101B, 98 feet; P101C, 165 feet; P102B, 65.4 feet; and P102C, 159.5 feet. Their locations are provided in Figure 1.



MAY 1991

FIGURE 1
SITE LOCATION MAP
(TECHNICAL MEMO)

HIMCO DUMP
SUPERFUND SITE
ELKHART, INDIANA

20626

ENGINEERS
ARCHITECTS
SCIENTISTS

A typical piezometer installation began with steam cleaning of the 2-inch diameter stainless steel well casing and plastic 1-inch diameter tremie pipe. Following steam cleaning, the 5-foot screen (Dietrich 2-inch I.D., flush-threaded, 0.010-inch slot, Schedule 5, Type 304 stainless) and riser (Dietrich 2-inch I.D., flush-threaded, Schedule 5, Type 304 stainless) were wrapped with teflon tape at the joints and threaded together before being lowered into the borehole. Enough 10-foot stainless steel sections were threaded together to allow a 2.5-foot riser stickup to extend above the ground surface. Excess stickup was cut off with a pipe cutter. In P102B, the annular space between the well screen and the borehole wall were backfilled with number 10-20 silica sand (Colorado Silica Sand, Colorado Silica Sand, Inc., Colorado Springs, Colorado) to 3.4 feet above the top of the well screen. P101B, P101C, and P102C were installed with natural formation sand which collapsed onto the well screen from 2 to 4 feet above the top of the well screen.

The placement of the filter pack was followed by the installation of a 2.5- to 3-foot thick bentonite slurry seal. From the bentonite seal to approximately 3 feet from ground surface, the annular space was backfilled with a cement/bentonite grout. A concrete collar was used to cement the protective casing (steel 4-inch diameter) in place. Vented, threaded PVC caps were installed at the top of the 2-inch risers. Protective casings were supplied with locking lids. Boring logs are provided in Appendix A. Well installation diagrams are provided in Appendix B.

Deviations

Intermediate piezometer P102B was installed at 65.4 feet rather than 100 feet since a silt and silty clay layer approximately 34 feet thick was logged beginning at approximately 65 to 70 feet while the boring for P102C was drilled. P102B was installed directly above this confining unit.

P102C was intended to be installed at 175 feet, however, a fine dense sand unit encountered at about 120 feet slowed down the rate of casing advance to less than 20 feet per hour. Very little water was being produced from this zone. Because driving casing became slowed to the point of futility, the well was installed at 159.5 feet by drilling beyond the 140-foot bottom of the 8-inch casing.

P101C was also intended to be installed at 175 feet, however, a large hole developed beneath the back of the rig by settling of sand during casing pounding. This problem, in addition to sand heaving up into the 8-inch casing, forced the installation to occur at 165 feet.

A natural formation sand was used in place of the specified filter pack sand in P102C, P101B, and P101C since sand immediately collapsed the borehole as the drill bit was removed. The 2-inch casing was installed beyond the bottom of the 8-inch casing by jetting water with a tremie pipe while allowing the weight of the 2-inch casing to sink it down to the previously drilled depth. Most of the jetted water circulated back up the 8-inch casing and was not lost to the formation.

Head pressures and loose formation sand also account for natural sand which blew up within the 8-inch casing before the bentonite slurry seal could be installed to the base of the 8-inch casing. Up to 2 feet of sand flowed up into the 8-inch casing prior to seal installation. Specific depths of seal placement are provided for each well in Appendix B.

Summary of Results

No samples were retained for this task. The stratigraphy at these locations is provided by boring logs for water table well locations and geotech borings.

The most significant challenge to overcome during these well installations was due to sand heaving up into the 8-inch casing while well installations were being done. The rate of sand heaving was fast enough so that by the time the drill stem was broken and pulled from the boring, up to 70 feet of sand had heaved up into the 8-inch casing. This sand had to be removed prior to well installation.

The sand was cleared from the casing at P102C by jetting water down into the 8-inch casing as the 2-inch casing was installed. Sand and water circulated up and out of the 8-inch casing which allowed the 2-inch casing to drop. Once the sand was removed from the 8-inch casing, further jetting below the 8-inch casing allowed the 2-inch casing to drop below the 8-inch casing and, therefore, expose the 2-inch casing to the formation. This method was required to expose the screen below the 8-inch casing because attempts to pull the casing up were not successful. Shallower installations at P101B and P102B, however, were installed by pulling the 8-inch casing up while the 2-inch casing remained stationary. The installation at P101C required additional effort since the 8-inch casing could not be pulled up, and jetting was not successful beyond the bottom of the 8-inch casing. After two attempts at jetting the well in place, the boring was overdrilled 10 feet and then jetted. This third attempt was successful.

TP/ke

A/P/HIMCO/AG3

APPENDIX A

APPROXIMATE BORING LOGS

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Engineers & Architects

COMPUTER AIDED DESIGN/DRAFTING

BORING LOG

SOIL BORING NO. P1C1B

SITE: Himco Dump PROJECT NO. 30030.037

DRILLING METHOD: 7 in Blade air, Air rotary, Sidedriven casing

LOG BY: TOM PULITALSKI

DRILLER: John Mathes / Mike Tinnin

WEATHER: 30° Windy ... Brew... Wet

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: Grass field

GROUND SURFACE ELEV.:

COORDINATES:

NORTH:

EAST:

DATE START: 12/13/90

DATE COMPLETE:

WELL INSTALLATION:

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2 / LEL	CO / H_2S
0													
		SM											
10													
		SM	10YR 4/1 Dark Grey Medium Grained Silty Sand, wet							1600	0	21.3 / 0.0	0.0 / 0.0
20													
30		GP	Poorly graded Gravel 65% 1" dia. stone, granite & black gneiss, 35% m/gr. dark grey sand saturated							1645	0	21.7 / 0.0	0.0 / 0.0
40													
50													
		SM	10YR 4/1 Dark Grey Silty Sand medium grained, saturated							1730	0	21.3 / 0.0	0.0 / 0.0
60			STOP ... 12/13/90 START ... 12/14/90										
70		GW	well graded GRAVEL 85% ½-3" stone & ... 15% medium grained sand wet										
		SM	10YR 2/1 Grey SILTY SAND 60% fine grn sand, 40% Silt							1109	0	21.3 / 0.0	0.0 / 0.0
80													
		~~SM~~											
90													
		SM	10YR 5/3 Brownish Brown SILTY SAND 70% fine grn sand 30% SILT, saturated							1220	0	21.7 / 0.0	0.0 / 0.0
100													

This is an approximate log based upon cuttings blown out of the boring during air rotary drilling.

Donohue

Engineers & Architects
COMPUTER AIDED DESIGN/DRAFTING

BORING LOG

SOIL BORING NO. P101C

SITE: Himco Dump PROJECT NO. 20036

DRILLING METHOD: Air Rotary with casing driver

LOG BY: S. Pedovani
DRILLER: Mike Tinnin - Mathes
WEATHER: cold/rain mixed w/ snow - High winds

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: Grass field

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: 12/3/90
DATE COMPLETE: 12/12/90
WELL INSTALLATION: 12/12/90

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	S	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2/LEL
			Multicolored ~~[illegible]~~ coarse grained sand							1000	.2	20/0
10			with pebbles									
20			Poorly sorted multicolored medium to coarse grained sand with pebbles							1600	.2	20/0
30												
40			SAND + Gravel							1700	.2	20/0
			Multicolored medium to coarse grained sand w/ pebbles									
60												
80										1100	.2	20/0
90			Fine to medium grained sand									
100			Fine to medium grained sand							1100	.2	20/0
110												
120			medium grained sand w/ <10% fine grained sand							1200	.2	20/0
130												
140			[illegible]									

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COMPUTER AIDED DESIGN/DRAFTING

BORING LOG

SOIL BORING NO. (B-101C)

SITE: Hime Dump PROJECT NO. 20026.003

DRILLING METHOD: 7 7/8" Blade bit
140-165 Air rotary 0-140 wash 140-165
0-140 7 7/8" tricone

LOG BY: TOM PUCHALSKI

DRILLER: MAX TINNIN DON BREWINGTON

WEATHER: Clear 40s SE wind N~15mph

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: Ag field

GROUND SURFACE ELEV.:

COORDINATES:

NORTH:

EAST:

DATE START: 12/3/90

DATE COMPLETE: 12/12/90

WELL INSTALLATION: 12/12/90

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	SAMPLING DATA B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	AIR MONITORING TIME	PID	O2/LEL	H2S
140		SP	10YR 5/3 Brown SAND, saturated										
150		SM	153' 10YR 5/2 Greyish Brown SILTY SAND 30-40% silt - Best fine sand										
		CL	Gray SILTY CLAY - On bit							1127	0	21.6/0.0	
160		CL	Gray SILTY CLAY - on drill bit Wash rotary to 165' 12/12/90 DSR										
170			Lost ~~200~~ ~100 gallons to formation 1515 12/12/90	EOB 175' 12/12/90 1528 TEP									
180			Lost ~150 gallons inside casing during attempted well installation on 12/11/90 ~~858~~ TEP										

This log is approximate. It is based on cuttings produced during air rotary drilling.

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COMPUTER AIDED DESIGN/DRAFTING

BORING LOG

SOIL BORING NO. R02B

SITE: Himco Dump PROJECT NO. 20026

DRILLING METHOD: Air rotary w/ 8" casing driver

LOG BY: S. Paterni

DRILLER: Max Thorne

WEATHER: Cloudy, Cool 40°F

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING:

GROUND SURFACE ELEV.:

COORDINATES:

NORTH:

EAST:

DATE START: 11/30/90

DATE COMPLETE: 12/1/90

WELL INSTALLATION: 12/1/90

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	AIR MONITORING TIME	PID	O_2 / LEL
			Brown medium to coarse grained Sand with gravel							1130	.2	20.9% / 0
10												
			Poorly sorted sand + gravel							1500	.2	20.9% / 0
30												
40			Poorly sorted Sand + Gravel							1550	.20	20.9% / 0
60			Poorly sorted Sand + gravel - Trace clay chunks PLENTY OF WATER							1745	.20	20.9% / 0
			BLIND DRILLING									

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COMPUTER AIDED DESIGN/DRAFTING

BORING LOG

SOIL BORING NO. P102C

SITE: Himco Dump PROJECT NO. 20026

DRILLING METHOD: Air Rotary

LOG BY: S. Padovani
DRILLER: Max Tunn - Mathes
WEATHER: Cold

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING:

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: 11/29/90
DATE COMPLETE: 11/30/90
WELL INSTALLATION: 11/30/90

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	S	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2/LEL
			Brown medium to coarse grained sand with gravel							1440	.2	20.8/0
10												
20			Poorly sorted grey Sand + Gravel							1530	.2	20.8/2
30												
40			Poorly sorted Sand + Gravel							1615	-	20.7/3
50												
60			Poorly sorted Sand w/ Gravel Medium grained sand w/ trace clay chunks ~~Clay~~ Silty fine grained sand Sandy Silt							1740	.2	21.0/3
70												
80			Sandy Silt / Silt							1000	.2	21.0/0
90			Silty clay / clay DRY!!!									
100			Clay : tight							1130	.2	21.0/0
110			Brownish well sorted medium grained sand. ~~Some~~ Trace gravel pieces @ 116'									
120			Brownish well sorted ~~[illegible]~~ Fine grained sand							1230	.2	20.0/0
130			VERY TIGHT FORMATION - Not much water Takes 1 1/2 hours to drive 30 feet									
140												

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COMPUTER AIDED DESIGN/DRAFTING

BORING LOG

SOIL BORING NO. (P102C)

SITE: Hamco Dump PROJECT NO. 20026

DRILLING METHOD: Air Rotary

LOG BY: S Padovani
DRILLER: Max Trenn - Mathes
WEATHER: Cold

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING:

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: 11/28/90
DATE COMPLETE: 11/30/90
WELL INSTALLATION: 11/30/90

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	S	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2 / LEL
			Brownish well sorted v. fine grained sand Tight!!! very little water							1500	.2	20.%
150												
160			Pounding the casing has become futile - Tom P., the drillers, and I agreed to set well screen at this depth									
170												

COMMENTS: 8" steel casing Down to 152.5'

: These soil descriptions and depths are approximate!

: BLIND DRILLING

* 500 gallons of water put down the well to hold formation back at 160'. However, most of this water exits out of the top of the 9" casing and does not enter the formation SBP 12/16/90

APPENDIX B

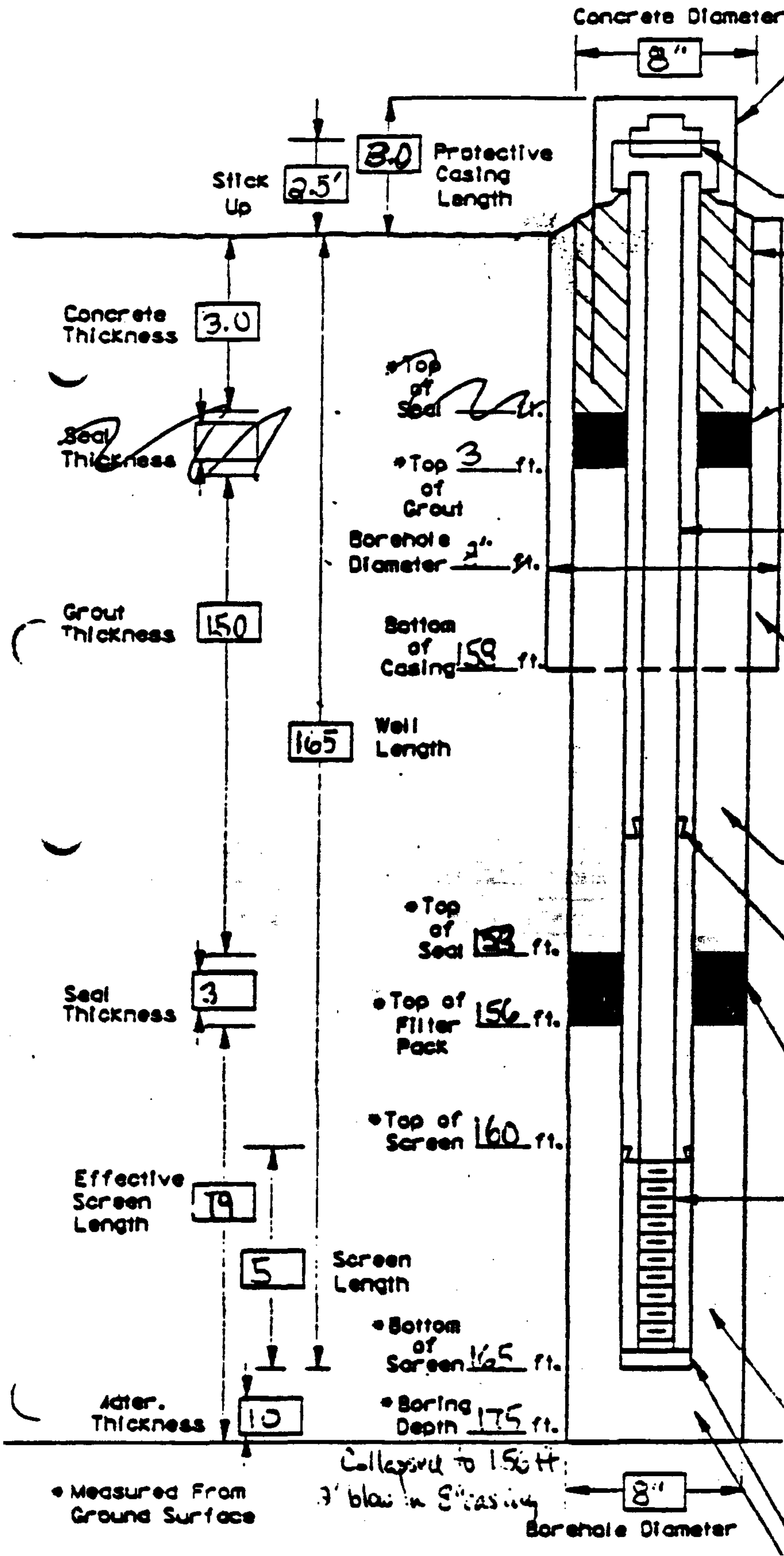
WELL INSTALLATION DIAGRAMS

Donohue
...neers & Architects
...UTER AIDED DESIGN/DRAFTING

DOUBLE CASING WELL/PIEZOMETER INSTALLATION DIAGRAM

Form

Site: HIMCC DUMP
Date: 12/12/90
Inspected By: Tom Pudzi...k
Project No. 20006.023
Well No. PICIC
Driller/Contractor MAX TINNIN, DON BREWINGTON / MATHES



PROTECTIVE CASING

Type Steel
Diameter 4"
Length 6.0'

GUARD POSTS

Vented (Yes)/No
Type Steel/Concrete
Locked Yes National fill...
Key # KA675

CAP OR PLUG Vented (Yes)/No Type PVC

CONCRETE COLLAR

Cement 5 lbs. + Water 2 1/2 gal.
Total Quantity 6 gal
Manufacturer Rite Mix

~~**UPPER SEAL**~~

~~Powder/Granular/Pellets Quantity ______ cc~~
~~Hydrated ______ gal., Time ______~~
~~Manufacturer ______~~

PIPE Type Stainless Steel Schedule 5 Type 304
O.D. 2.4 " I.D. 2.0 "
Length/Sec. 10 feet No. Of Sec. 16+1 cut
Manufacturer Dietrich ...

GROUT Type Cement / Bentonite 3 2/5 Batches
Mix 846 lbs. of TYPE I-A Portland +
45 lbs. of Bentonite powder +
Water 80 gals. Total Quant. 150 gal.
Manufacturers Portland-Lafarge Bentonite ...

~~**OUTSIDE GROUT** Type ______~~
~~AMOUNT ______~~

JOINTS Flush Threaded (Yes)/No
Teflon Taped (Yes)/No O-Ring Yes/(No)
Manufacturer Dietrich

LOWER SEAL

(Powder)/~~Pellets Quantity~~ 10 lbs ~~gal~~
Hydrated Slurry 10 gal., ~~Time~~
Manufacturer NATURAL GEL WYO-BEN PRODUCTS

SCREEN

Type Continuous Wrap Stainless Schedule 5
Length/Sec. 5 ft No. of Sec. 1
O.D. 2.4" " I.D. 2.0" "
Slot Size .010 ~~No. Slots/ft.~~
Manufacturer Dietrich

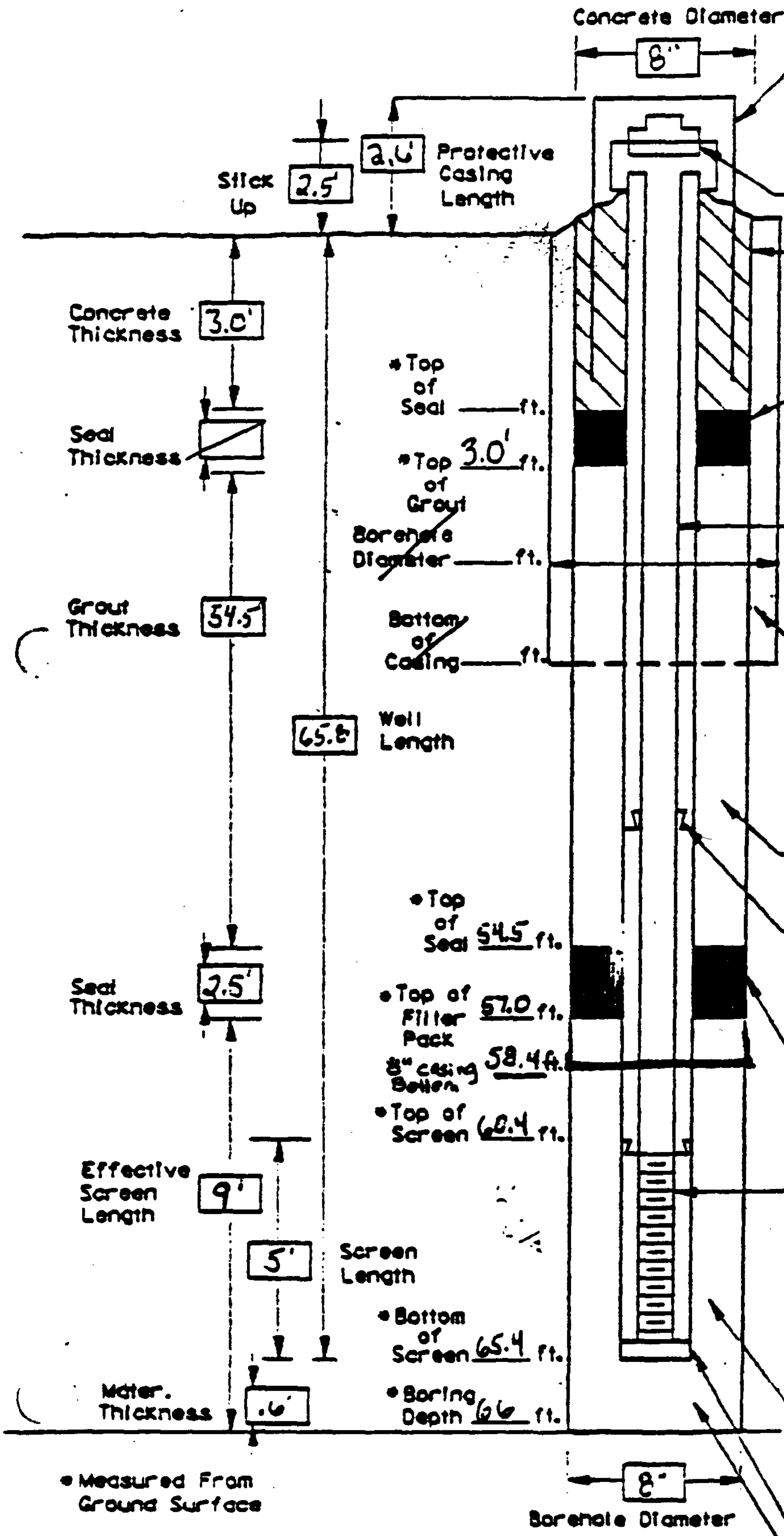
FILTER PACK Type(s) Natural Formation
Source Fine Silty Sand ~~Volume ______ gal.~~
~~Manufacturer~~

PLUG OR CAP Type Stainless Length 1"

Donohue Engineers & Architects
COMPUTER AIDED DESIGN/DRAFTING

DOUBLE CASING WELL/PIEZOMETER INSTALLATION DIAGRAM

Site: Himco Dump   Date: 12/2/90
Inspected By: S. Padovani   Project No. 20076   Well No. P102B
Driller/Contractor: Max Tinnin / Mathes



PROTECTIVE CASING
Type Steel   Vented Yes/No   Diameter 4"   Locked Yes   Length 4'   Key # 192-641

GUARD POSTS
Type Loose (?) Her

CAP OR PLUG Vented Yes/No   Type PVC

CONCRETE COLLAR
Cement 50 lbs.+Water .5 gal.
Total Quantity ___
Manufacturer ___

~~UPPER SEAL~~
Powder/Granular/Pellets Quantity ___
Hydrated ___ gal.. Time ___
Manufacturer ___

PIPE Type Stainless Steel   Schedule 5
O.D. 2 3/8"   I.D. 2"
Length/Sec. 10'   No. Of Sec. 6
Manufacturer Diedrich

~~GROUT~~ Type ___
Mix ___ lbs. of ___ +
___ lbs. of ___ +
Water ___ gals.   Total Quant. ___
Manufacturers ___

OUTSIDE GROUT Type Bentonite-Portland Mix
AMOUNT 9 gal H₂O, 7 bags portland (94 lb/bag), 45 lbs bo[...]

JOINTS Flush Threaded Yes/No
Teflon Taped Yes/No   O-Ring Yes/No
Manufacturer ___

LOWER SEAL
Powder/Pellets Quantity 5
Hydrated by formation water gal.. Time 1100
Manufacturer Lafarge

SCREEN
Type Stainless Steel   Schedule 5
Length/Sec. 6.8'   No. of Sec. 1
O.D. 2 1/4"   I.D. 2"
Slot Size 10   No. Slots/ft. 180
Manufacturer Diedrich

FILTER PACK Type(s) Natural gravel wi[...]
Source Ozark Mountains   Volume ___
Manufacturer General Material

PLUG OR CAP Type Stainless Steel   Length 1.5'

Donohue DOUBLE CASING WELL/PIEZOMETER INSTALLATION DIAGRAM

Form

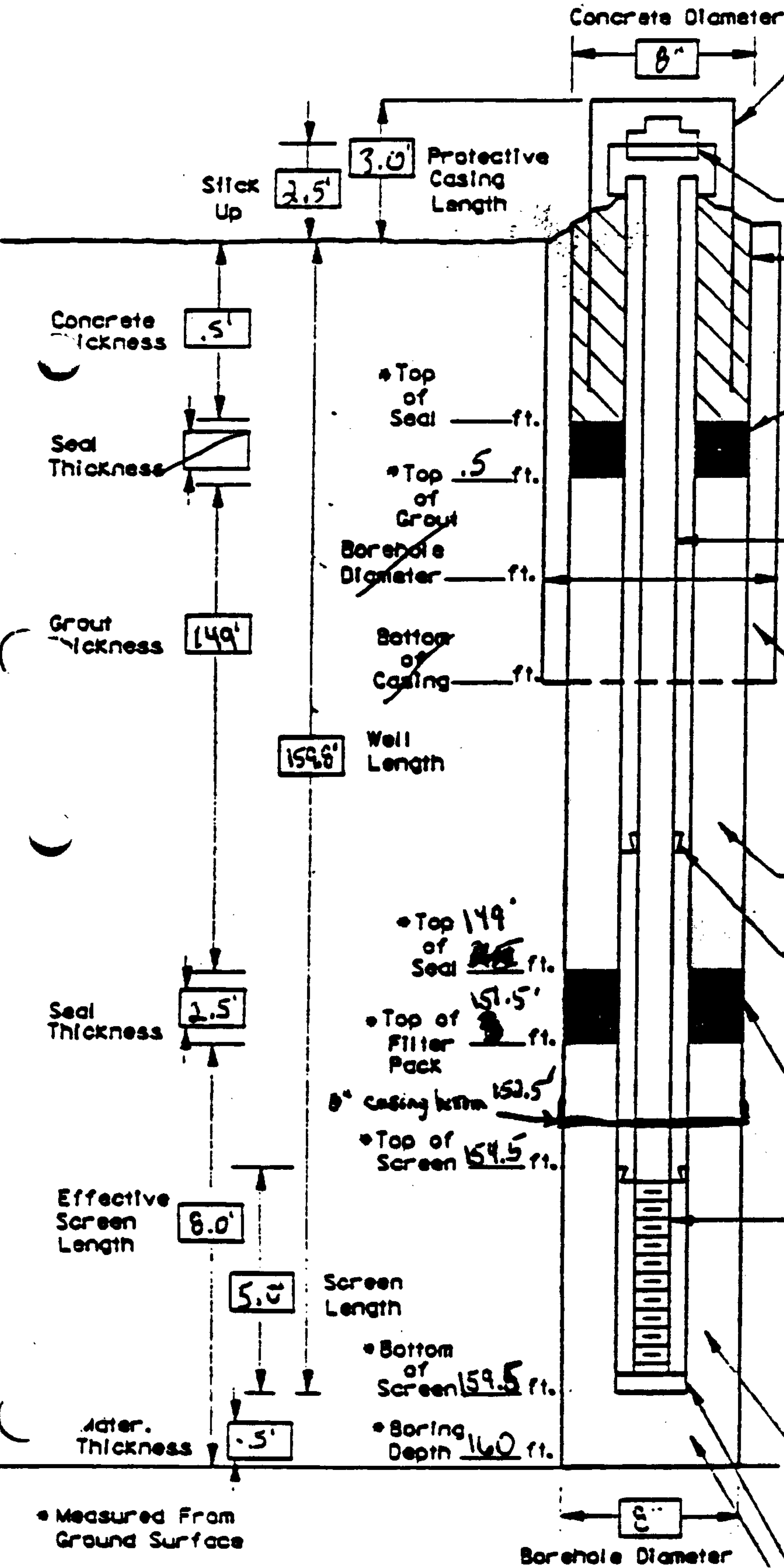
Site: Himco Dump Date: 12/1/90

Inspected By: S. Paderani Project No. 20026 Well No. P102C

Engineers & Architects

COMPUTER AIDED DESIGN/DRAFTING

Driller/Contractor Max Tinnen / Mathes



PROTECTIVE CASING **GUARD POSTS**

Type Steel Vented (Yes)/No Type Louie Fitch

Diameter 4" Locked Yes

Length 4' Key # 192-641

CAP OR PLUG Vented Yes/(No) Type ___

CONCRETE COLLAR

Cement .50 lbs.+Water .5 gal. ___

Total Quantity ___ gal

Manufacturer ___

UPPER SEAL

Powder/Granular/Pellets Quantity ___ gal

Hydrated ___ gal.. Time ___

Manufacturer ___

PIPE Type Stainless Steel Schedule 5

O.D. 2 3/8" I.D. 2"

Length/Sec. 10ft/sec. No. Of Sec. 16 + 1/4 sec.

Manufacturer Diedrich

GROUT Type ___

Mix ___ lbs. of ___ +

___ lbs. of ___ +

Water ___ gals. Total Quant. ___ gal.

Manufacturers ___

OUTSIDE GROUT Type Cement-bentonite grout - Volclay

AMOUNT 425 gal

JOINTS Flush Threaded (Yes)/No ___

Teflon Taped (Yes)/No O-Ring Yes/No

Manufacturer ___

LOWER SEAL

(Powder)/Pellets Quantity ~10 gal.

Hydrated ___ gal..Time ___

Manufacturer Lafarge

SCREEN

Type ~~Stainless~~ steel Schedule 5

(Length)/Sec. 5.8 No. of Sec. 1

O.D. 2 3/8" I.D. 2"

Slot Size 10 No. Slots/ft. 180

Manufacturer Diedrich

FILTER PACK Type(s) Natural Material 160 - 154.5 ; ___

Source Ozark Mountains Volume ___ gal.

Manufacturer Glacial material

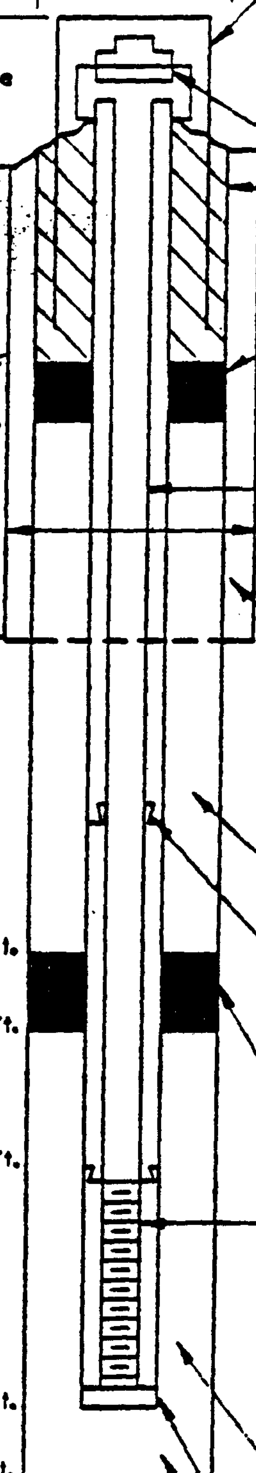
PLUG OR CAP Type Steel Length 1.5"

Donohue
Engineers & Architects
COMPUTER AIDED DESIGN/DRAFTING

DOUBLE CASING WELL/PIEZOMETER INSTALLATION DIAGRAM

Form

Site: Himco Dump Date: 12/14/90
Inspected By: Tom Puchalski Project No. 20076.023 Well No. P101B
Driller/Contractor Max Tinnin Don Brewington / MO



Concrete Diameter 8"
Protective Casing Length 3.0
Stick Up 2.5
Concrete Thickness 4.0
~~Top of Seal ft.~~
~~Seal Thickness~~
*Top of Grout 4 ft.
Borehole Diameter 8" ~~ft.~~
Grout Thickness 84
Bottom of Casing 91 ft.
Well Length 98
*Top of Seal 88 ft.
Seal Thickness 3.0
*Top of Filter Pack 91 ft.
*Top of Screen 93 ft.
Effective Screen Length 9
Screen Length 5
*Bottom of Screen 98 ft.
Mater. Thickness 2.0
*Boring Depth 100 ft.
Borehole Diameter 8"

* Measured From Ground Surface

Boring collapsed on screen and out of 8" casing as it was pulled

PROTECTIVE CASING
Type Steel Vented (Yes)/No
Diameter 4" Locked Yes National
Length 6.0' Key # KA675

GUARD POSTS
Type Steel/Cement filled

CAP OR PLUG Vented (Yes)/No Type PVC

CONCRETE COLLAR
Cement 165 lbs.+Water ~~12~~ 5 gal.
Total Quantity 12 gal.
Manufacturer Rite Mix

~~UPPER SEAL~~
~~Powder/Granular/Pellets Quantity~~
~~Hydrated gal., time~~
~~Manufacturer~~

PIPE Type Stainless Steel Schedule 5 Type 304
O.D. 2.4" I.D. 2.0"
Length/Sec. 10 feet No. Of Sec. 10
Manufacturer Dietrich

GROUT Type Cement/Bentonite (Batch 12)
Mix 846 lbs. of Type IA Portland
45 lbs. of bentonite powder +
Water 80 gals. Total Quant. 150 gal.
Manufacturers Portland-Lafarge Bentonite Wyo.

~~OUTSIDE GROUT~~ ~~Type~~
~~AMOUNT~~

JOINTS Flush Threaded (Yes)/No
Teflon Taped (Yes)/No O-Ring Yes/(No)
Manufacturer Dietrich

LOWER SEAL
(Powder)/Pellets Quantity 10 lbs
~~Hydrated~~ Slurry 15 gal., ~~time~~
Manufacturer Naturalgel WYOBEN PRODUCTS

SCREEN
Type Schedule
Length/Sec. 5 ft No. of Sec. 1
O.D. 2.4" I.D. 2.0"
Slot Size .010 ~~No. Slots/ft.~~
Manufacturer Dietrich

FILTER PACK Type(s) Natural Formation Sand
~~Source~~ Fine silty Sand ~~Volume~~
~~Manufacturer~~

PLUG OR CAP Type Stainless Length 1"

MATERIAL Natural Formation Fine grained silty Sand

WATER SOURCE Fire hydrant in front of Elkhart Water Works

TECHNICAL MEMORANDUM NUMBER 2

DATE: January 23, 1991

TO: Vanessa Harris - Site Manager

CC: Marcia Kuehl - RI Lead
Roman Gau - Project Manager
Mike Crosser - TSQAM

PRELIMINARY

FROM: Tom Puchalski

SUBJECT: EPA ARCS Region V Contract No. 68-W8-0093
EPA Work Assignment No. 175L4J
Donohue Project No. 20026.024
Himco Dump

WELL DEVELOPMENT

Introduction

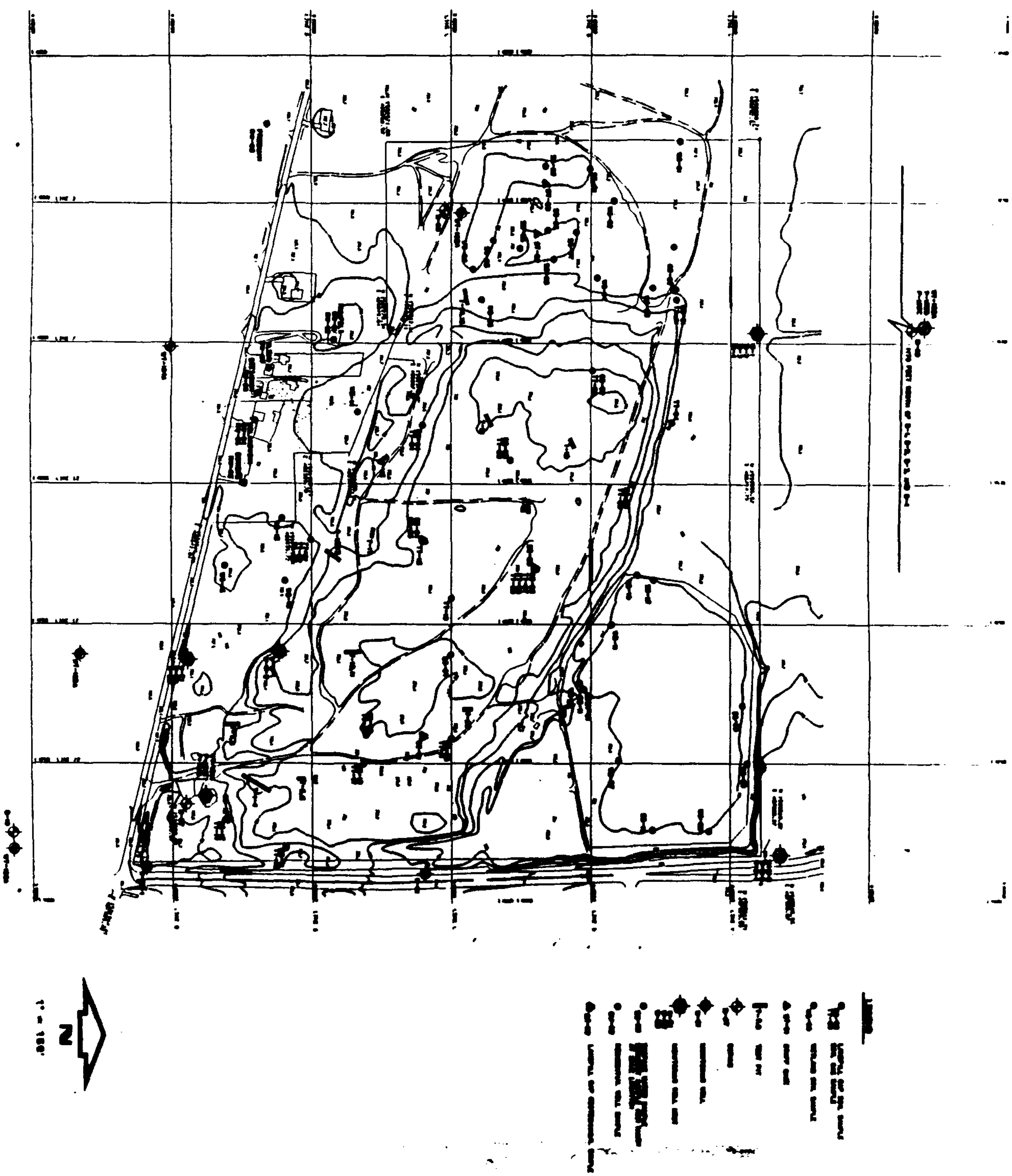
All newly installed groundwater monitoring wells at the Himco Dump site in Elkhart, Indiana, were developed a minimum of 24 hours after their installation. Water table wells were developed on November 13 and 14, 1990, and piezometers were developed December 15 and 16, 1990. Developed water table wells include WT101A, WT102A, WT103A, WT104A, WT105A, and WT106A. Developed piezometers include P101B, P101C, P102B, and P102C. The locations of these wells are provided in Figure 1 of this memorandum. Water table wells were developed by John Mathes & Associates, Inc., and Eric Slusser of Donohue & Associates, Inc. Piezometers were developed by Max Tinnin and Don Brewington of John Mathes & Associates, Inc., and Tom Puchalski of Donohue & Associates, Inc. Wells were developed to remove sediment from the well and to allow the maximum amount of groundwater to enter the well for groundwater sampling. Well development helps assure that a representative groundwater sample is obtained.

Methods

Well development was carried out as specified in the Final Field Sampling Plan, Himco Dump Remedial Investigation/Feasibility Study Elkhart, Indiana, Section 4.2.2.3.

The development method for water table wells was different from the development method for piezometers. Water table wells were pumped by hand using a Brainard Killman hand pump.

Piezometers were developed using compressed air provided by the TH60 drill rig. An air purging device developed by John Mathes & Associates, Inc., was used. This device consists of a compressed air line attached to a tube directed down into the well which takes an 180-degree bend upward into the



MAY 1991

FIGURE 1
SITE LOCATION MAP
(TECHNICAL MEMO)

HIMCO DUMP
SUPERFUND SITE
ELKHART, INDIANA

20629

Donohue ENGINEERS ARCHITECTS SCIENTISTS

base of a 1-1/2-inch I.D. plastic water hose. The air lifts the sand and water up through the plastic hose. This method was used for these deep wells because a high volume of water and sand was required to be removed in a short amount of time.

Pumps with sufficient pumping rates are not available for 2-inch wells. The air developer served to remove the sand from the well and purge the groundwater in a reasonable amount of time.

Pumping of the well continued until at least five well volumes were removed and the purge water was silt free, the water temperature was stabilized to ±0.5°C, pH was stabilized to ±0.1 units, and conductivity was stabilized to ±10 percent.

Measurements of pH, conductivity, color, temperature, and turbidity were recorded at least once after each of the five well volumes were purged.

Deviations

High pressure hot water washing of the Brainard Killman hand pump and the air development pump was used for decontamination between wells instead of soap and water, isopropanol, and deionized water as was described in Section 4.2.2.4 of the sampling plan. The lengths of PVC connections and lengths of the exit hose and air compressor hose were not easily cleaned by hand. The high pressure hot water wash provided a quicker and more thorough method of decontamination for this equipment.

The sampling plan specified using a submersible pump for well development. The air development device used by Mathes for the development of the piezometers was used in place of a submersible pump. No submersible pump is available which could pump out the sand and purge the groundwater as quickly from a 2-inch well as did the air development tool.

Summary of Results

Copies of completed field forms are provided in Appendix A. The development methods successfully cleared the sand and silt from the installed groundwater monitoring wells and removed the required purge volumes so that a representative groundwater sample could be collected after the wells had stabilized for a minimum of two weeks. All groundwater wells provided sufficient groundwater volume to conduct groundwater sampling.

TP/ke

A/R/HIMCO/AA9

APPENDIX A

WELL DEVELOPMENT DATA

Sheet ____ of ____

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Well Development

Project No. 20026.023 Site Hines Dump

Method of Development Pumped X Bailed ____ Blown ____ Surge Block ____

Equipment ____ Airlift ____ N2 Lift ____ In. Bailer ____ Length 5 Ft. Material ____

Pump PVC ____ Manufacturer Brainard Kilman Diameter 1¼" 10 5' section

Description of site (weather, temp, soil conditions) Sand, Sunny, mid 40s

Well No. / Time	Depth to Water	Depth to Bottom	Volume Removed (gal.)	Depth After	pH	Cond.	Color	Odor Y/N	Temp.	Turbidity	Comments
WT104A 11:15	9.38	18.47	4		7.34	501	Br	N?	54.9	V turb.	11:37 initial
11:44			16		7.14	869	Lt Br		54.1	turb.	
11:45			24		7.11	876	Lt Br		54.1	Slightly turb.	
11:49			32		7.08	895	V Lt Br		54.1	Slightly turbid	
11:53			40		7.11	896	V Lt Br		54.1	V slight	
12:05			50	9.38	7.13	898	Clear		54.4	Clear	

11:49

Additional Notes: 2" well πr^2 7.48 = 0.163 WC = 9.09 9.09 x 0.163 = 1.48

8" sand pack 2.611 x 9.09 = 23.73 x .3 = 7.12

7.12 - 1.48 = 5.64 Sand pack 30% - 2" well

~~5.64 + 1.48 = 7.12 1 well~~ vol gal

~~3 well~~ x 1.48 + 6.68 = 8.16 1 well vol

22.25

Entered on computer ____ Signature [illegible] Date 11/14/9[illegible]

Sheet____ of ____

Donohue
Engineers & Architects

Well Development

Project No. 20026.023 Site Himes Dump

Method of Development Pumped X Bailed ____ Blown ____ Surge Block ____

Equipment ____ Airlift ____ N2 Lift ____ In. Bailer 1 1/4" Length 5 Ft. Material ____

Pump PVC Manufacturer Brainard Kilman Diameter 1 1/4" 10 5' Section

Description of site (weather, temp, soil conditions) Warmer Sunny 40's – 46°

11-13-97

Well No / Time	Depth to Water	Depth to Bottom	Volume Removed (gal.)	Depth After	pH	Cond.	Color	Odor Y/N	Temp.	Turbidity	Comments
WT 105A 2:44	10.20	18.52	8		7.77	363	Br	?	53.4	V turbid	Pumping 2:42
2:49			16	~~18~~	7.79	435	Br		52.8	turbid	
2:52			24		7.81	430	Br		52.5	turbid	
15:10			32		7.89	399	Br		50.0	turbid	
15:16			40		7.90	410	Lt Br		50.1	turbid – slightly turbid	
15:20			55	10.29	7.92	412	Lt Br		50.3	turbid – slight	

Additional Notes: W = H D   2" well .163   8" 2.661

W = 8.32

S = [(H x B) – W] x .3

T = W + S

2" H x D = .163 x 8.32 = 1.36 1 well vol – 2" pin

8" = [(2.661 x 8.32) – (1.36)] x .3 = Sand pack
21.72 – 1.36

[20.36] x .3 = 6.11 + 1.36 = 7.47 = 1 well vol

W water well vol

H height of column

D borehole diam gal/ft

T total vol of well + sand pack.

B Borehole diam

Sheet ____ of ____

Donohue
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Well Development

Project No. 20026.023 Site Himco Dump

Method of Development Pumped X Bailed ____ Blown ____ Surge Block ____

Equipment ____ Airlift ____ N2 Lift ____ In. Bailer ____ Length ____ Ft. Material ____

Pump PVC Manufacturer Brainard Kilman Diameter 1¼" 5' section

Description of site (weather, temp, soil conditions) Warm Sunny 45°

11-13-90

Well No / Time	Depth to Water	Depth to Bottom	Volume Removed (gal.)	Depth After	pH	Cond.	Color	Odor Y/N	Temp.	Turbidity	Comments
WT-104B 5:09	12.34	18.66	3		8.4	208	Br	N	49	v turbid	
5:10			6		8.44	218	Br	N	49.8	v turbid	
5:12			15		8.50	219	Br	N	51.2 ~~49.6~~	turbid	
5:15			24		8.52	224	Lt Br	N	51.6	turbid	
5:21			30	12.31	8.40	218	Lt Br	N	51.1	turbid	

set up 4:
start surge 5:0
swabing

Additional Notes: W = HD = 1.03 2" well H = 6.32 water column

S = [(H×D) − W] .3 = [(2.61 × 6.32) − 1.03] .3 =

T = W+S (16.50 − 1.03) .3

(15.47) .3 = 4.64 + 1.03 = 5.67 = 1 well vol

Signature ______ Date 11/14/90

Sheet ______ of ____

Donohue
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Well Development

Project No. 20026.023 Site Himes Dump

Method of Development Pumped X Bailed ______ Blown ______ Surge Block ______

Equipment ______ Airlift ______ N2 Lift ______ In. Bailer ______ Length ______ Ft. Material ______

Pump PVC Manufacturer Brainerd Kilmer Diameter 1¼" 10 5' section

Description of site (weather, temp, soil conditions) Sunny Cool 40s

11-14-92
start
9:40

Well No / Time	Depth to Water	Depth to Bottom	Volume Removed (gal.)	Depth After	pH	Cond.	Color	Odor Y/N	Temp.	Turbidity	Comments
WT-103B 9:49	6.10	18.44	3		7.79	665	Br	N	57.2	V turbid	initial
9:55			22		7.69	675	Lt Br	Y	56.1	Slightly turb	Surged 5 min Very Small on Sulfur
10:07			33		7.68	687	Lt Br	Y	57.1	Slightly turbid	Very Sulfur Smell
10:11			44		7.61	711	clear	Y	57.5	clear	Slight Sulfur Smell? or Iron
10:16			55		7.60	725	clear	Y	57.5	clear	" "

Additional Notes: 2" well .163 8" 2.611 H = 12.34 ft

H = Water column
W = 2" well volume
~~B~~ ~~ft~~ borehole dia:
T = Sand pack and well vol.

W = HD 0.163 x 12.34 = 2.01 gal.

S = [(H x B) − W] 0.3 [(2.611 x 12.34) − (2.01)] = (30.21)(.3) =
32.22 9.063

T = W + S

T = 9.063 + 2.01 = 11.07 gallons 1 well vol including sand pack and pipe

Sheet ____ of ____

Donohue
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Well Development

Project No. 20026.023 Site Himes Dump

Method of Development Pumped X Bailed ____ Blown ____ Surge Block ____

Equipment ____ Airlift ____ N2 Lift ____ In. Bailer 1 1/4" Length 5 section Ft. Material ____

Pump PVC Manufacturer Brainard Kilman Diameter 1 1/4" ID

Description of site (weather, temp, soil conditions) Cool sunny 40s - 50s by noon

11-14-90

Well No / Time	Depth to Water	Depth to Bottom	Volume Removed (gal.)	Depth After	pH	Cond.	Color	Odor Y/N	Temp.	Turbidity	Comments
WT 106A 11:18	10.98	18.09	3		7.45	1160	Br	N	54	V turbid	muddy 5 gal - surged 5 min
11:23			13		7.46	1322	Br	N	53.2	V turbid	Surge 5 min at 15 gal
11:30			19		7.40	1352	Br	N	52.8	V turbid	
11:34			26		7.45	1351	Br	N	53.3	tu	
11:36			33		7.42	1370	Br	N	53.3	turbid	
11:44			55	10.98	7.42	1355	V Lt Br	N	53.3	V slightly turbid	

Additional Notes: 2" .163 8" 2.611

W = HD = .163 x 7.11 = 1.16

S = [(H x B) - W] .3 = [18.56 - 1.16] .3 = 5.22 gal
17.40

total well + sand pack = W + S = 5.22 + 1.16 = 6.38 gal

H = height of water = 7.11 ft

S sand pack volume

B borehole diam

W well volume

T sand pack and well

Sheet ____ of ____

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Well Development

Project No. 20026.023 Site Himco Dump

Method of Development Pumped X Bailed ____ Blown ____ Surge Block ____

Equipment ____ Airlift ____ N2 Lift ____ In. Bailer ____ Length ____ Ft. Material ____

Pump PVC Manufacturer Brainard Kilman Diameter 1 1/2" ID 5' Scr.

Description of site (weather, temp, soil conditions) Cool, Sunny, low 50's

11-14-90

Well No / Time	Depth to Water	Depth to Bottom	Volume Removed (gal.)	Depth After	pH	Cond.	Color	Odor Y/N	Temp.	Turbidity	Comments
W-10(8) 13:51	11.48	18.67	3		6.81	1319	br	N	51.2	V turbid	13.49 surging
14:00			13	1	6.73	1408	br br	N	57.1	turbid	surging at 13 gal 5 min
14:08			20		6.76	1414	Brk	N	57.7	turbid	
14:11			27		6.76	1420	Lt Y Br br	N	57.6	turbid	
14:13			34		6.74	1428	Lt Y Br br	N	57.9	slightly turbid	
14:18			55	1.48	6.77	1414	Lt Y Br br	N	57.4	V slightly turbid	

Additional Notes: 2" 0.163 8" 2.611 H = 7.19' H = ~~length~~ thickness of water column

W = H x D = .163 x 7.19 = 1.17 S = Sand pack volume

S = [(H x B) - W] 0.3 = (18.77 - 1.17) .3 = (17.60) .3 = 5.28 D = diameter ~~borehole~~ well

T = W + S 5.28 + 1.17 = 6.45 gal. - 1 well vol B diameter borehole

W well volume

T = Sand pack and well

Sheet 1 of 1

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Well Development 12/15/96

Project No. 20026.033 Site Himco Dump

Method of Development Pumped ✓ Bailed ____ Blown ____ Surge Block ____

Equipment ✓ Airlift ~~✓~~ N2 Lift ____ In. Bailer ____ Length 160 Ft. Material ASTM D2233 Plastic Exit Hose

Pump Air rig Manufacturer Mathes Diameter 3/4"

Description of site (weather, temp, soil conditions) 44°F, south wind 10-15mph, partly sunny; wet soil

Well No / Time	Depth to Water	Depth to Bottom	Volume Removed (gal.)	Depth After	pH	Cond.	Color	Odor Y/N	Temp.	Turbidity	Comments
P102C 1324	10.57	136.81	15		5.91	478	Brown	N	51.2	High	Silty
1333			60		6.05	474	Lt Brn	"	51.2	Med	Silt settling out
1345			100		5.91	452	Lt Gray	"	51.0	Low	Silt settling out
1357			140		6.04	441	"	"	50.4	"	Silt & fine sand settling
1513			190		5.90	457	Clear	"	48.4	None	Fine sand ~1mm in jar
1526			215		6.18	436	"	"	10°C	None	"
1530			230	159.50	6.14	411	"	"	10°C	"	"

Additional Notes: Initial air surge blew sand from screen

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Well Development 12/15/90

Project No. 30022.033 Site Himco Dump

Method of Development Pumped ✓ Bailed ___ Blown ___ Surge Block ___

Equipment ✓ Airlift ✓ N2 Lift ___ In. Bailer ___ Length 100 Ft. Material ASTM D2233 Plastic Hose

Pump Air supplied by rig Manufacturer Mathes Diameter 3/4" exit hose

Description of site (weather, temp, soil conditions) 43°F, South wind 14 mph, partly sunny, soil wet

Well No. / Time	Depth to Water	Depth to Bottom	Volume Removed (gal.)	Depth After	pH	Cond.	Color	Odor Y/N	Temp.	Turbidity	Comments
P102B 1200	9.90	67.29	30		5.93	604	Lt Grey	N	49.2	Slight grey	
1210			40		6.46	633	Clear	N	50.9	None	
1215			50		6.54	634	"	"	57.0	"	
1229			75		5.87	643	"	"	51.1	"	
1240			130		6.29	634	"	"	50.4	"	
1245			140		6.31	642	"	"	51.5	"	
1249			160		6.11	641			51.4		
1257	9.90	67.29		67.29							

Additional Notes: Initial air surge blew sand from screen.

Sheet 1 of 1

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Well Development 12/15/90

Project No. 20076.023 Site Himco Dump

Method of Development Pumped ✓ Bailed ______ Blown ______ Surge Block ______

Equipment ✓ Airlift ______ N2 Lift ______ In. Bailer ______ Length 100 Ft. Material ASTM D2233 Plastic Exit Hose

Pump Air Rig Manufacturer Mathes Diameter 3/4"

Description of site (weather, temp, soil conditions) 40°F, south wind 10-20 mph, overcast, wet soil

Well No / Time	Depth to Water	Depth to Bottom	Volume Removed (gal.)	Depth After	pH	Cond.	Color	Odor Y/N	Temp.	Turbidity	Comments
P101C 1626	12.57	160.37			BEP	12/15/90					
1656			30		~~11.52~~	~~728~~	Clear	N	12°C	None *	pH meter malfunction
1706			70		*	677	Clear	N	12°C	None	can't recalibrate pH
1718			125			677	"	"	12°C	"	
1729			180			666	"	"	12°C	"	
1739			275			668	"	"	12°C	"	
1745			300			666	"	"	12°C	"	
		166.54		14.22							

Additional Notes: Initial air surge blew sand from screen

Sheet 1 of 1

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Well Development 12/16/90

Project No. 20036.023 Site Himco Dump

Method of Development Pumped ✓ Bailed ____ Blown ____ Surge Block ____

Equipment ✓ Airlift ____ N2 Lift ____ In. Bailer ____ Length 100 Ft. Material ASTM D2233 Plastic Exit Hose

Pump Air Rig Source Manufacturer Mathes devised pump Diameter 3/4"

T760 Ingersol Rand

Description of site (weather, temp, soil conditions) 40°F, calm, overcast, foggy, drizzle, wet soil

Well No / Time	Depth to Water	Depth to Bottom	Volume Removed (gal.)	Depth After	pH	Cond.	Color	Odor Y/N	Temp.	Turbidity	Comments
P101B 815	9.57	92.30	50		7.18	802	Clear	N	52.4	None	No sand or silt
" 833			80		7.26	1010	"	"	11°C	"	"
" 840			150		7.25	1090	"	"	12°C	"	"
" 848			190		7.29	1118	"	"	12°C	"	"
" 855			225		7.28	1119	"	"	11.5°C	"	"
" 904			300		7.36	1173	"	"	12°C	"	"
" 910	10.52	100.60		100.60							

Additional Notes: Initial air surge blew sand out of screen

TECHNICAL MEMORANDUM NUMBER 3

DATE: January 21, 1991

TO: Vanessa Harris, Site Manager

CC: Marcia Kuehl, RI Lead
Roman Gau, Project Manager
Mike Crosser, TSQAM

PRELIMINARY

FROM: Tom Puchalski

SUBJECT: EPA ARCS Region V Contract No. 68-W8-0093
EPA Work Assignment No. 175L4J
Donohue Project No. 20026.024
Himco Dump

STAFF GAUGES

Introduction

Three staff gauges were installed at the Himco Dump Site; one was installed in the gravel pit pond at the northeast area of the site, one was installed at the "L"-shaped fish pond at the southwest corner of the site, and one was installed at the smallest pond on-site located east of the "L"-shaped fish pond (Figure 1). The posts for anchoring the gauges were installed on October 24, 1990, by Eric Slusser and Tom Puchalski of Donohue & Associates, Inc. The gauges were installed onto the posts by Anya Kirykowicz and Steve Spiewak on December 14, 1990.

The staff gauges were installed in order to gather surface water elevation data. The measurements were taken on the same days as groundwater elevations from monitoring wells so that interconnection of groundwater and surface water can be evaluated.

Methods

The installation of staff gauges proceeded as described in Section 4.3 Surface Water Hydraulic Monitoring of the Final Field Sampling Plan, Himco Dump RI/FS, Elkhart, IN. The actual material used for the anchor posts for staff gauges deviated from what was described in the sampling plan. Two-inch I.D. electrical conduit in 8- or 10-foot lengths were used in place of the coupled galvanized steel described in the plan.

Anchor posts were driven into the bottom sediments of the ponds with a post driver. Hip waders were used to allow the installation in water approximately 2 feet deep about 3 to 5 feet from the shoreline. About 4 feet of the posts remained above water after driving in-place to allow the attachment of a sheet metal rule marked to 0.01-foot.

The sheet metal rules were attached to the anchor posts by bolts which pass through the rule and into the posts. Holes were drilled in the posts to accommodate the bolts by using an electric drill at each staff gauge location. A gasoline powered electric generator was used to power the drill. The sheet metal rules were anchored with the top of the rule flush with the top of the anchor post. The elevations of the tops of the anchor posts were surveyed by Lang Feeney of South Bend, Indiana, on December 16, 1990.

Deviations

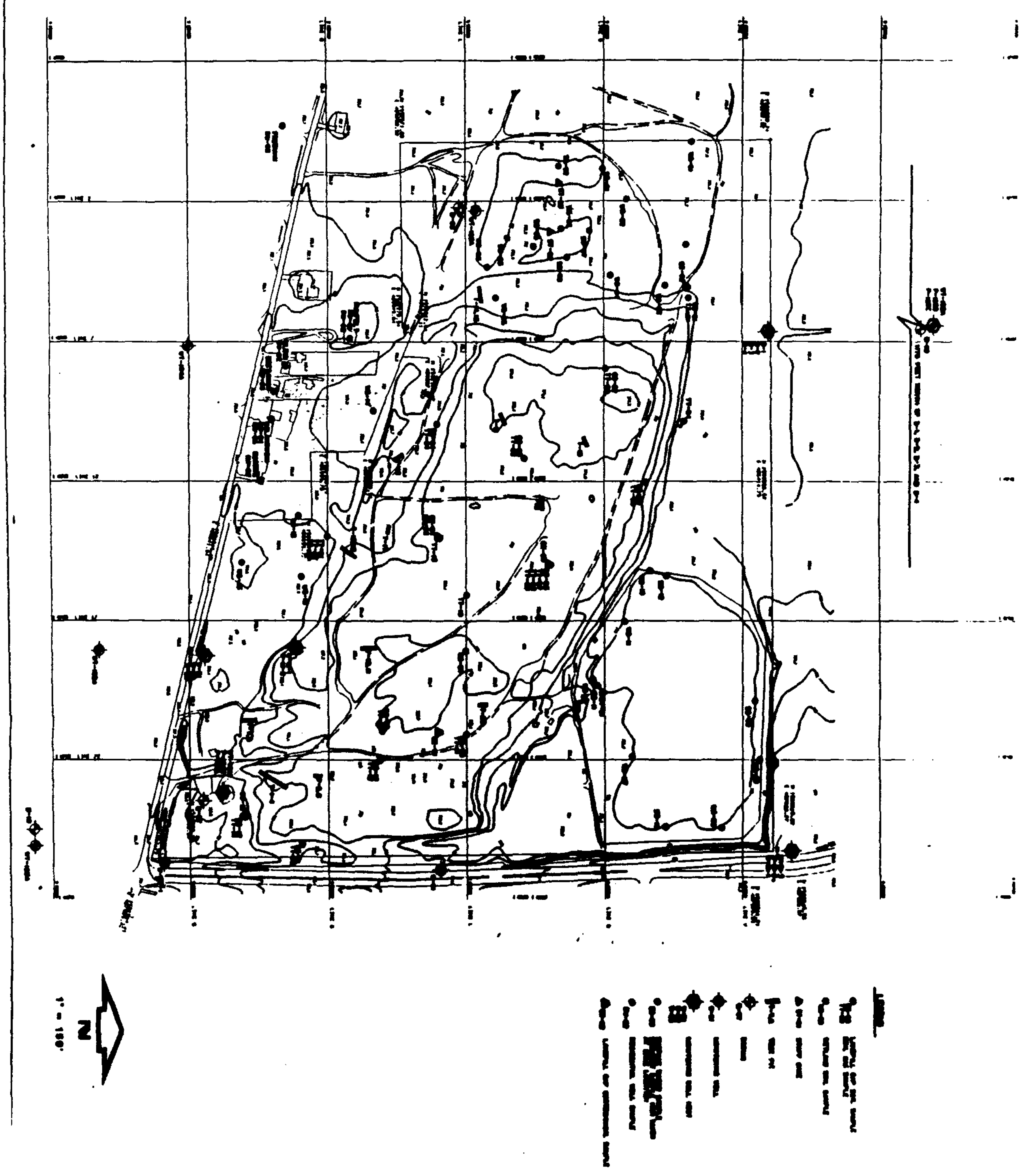
The locations deviate slightly from those shown in Figure 4-1 of the sampling plan. While the ponds shown in Figure 4-1 all have gauges installed, Figure 1 of this memorandum more accurately locates the actual staff gauge locations within each pond. The locations were modified to account for shoreline and bottom sediment conditions which were most favorable for the staff gauge installations. The conditions include consolidated bottom sediments, which provide a sturdy anchoring of the post, and the absence of shoreline brush which makes accessing and reading the gauges difficult.

Summary of Results

A table of the observed surface water levels and groundwater monitoring well water level elevations are included in Appendix A. Measurements of the level of ice during months when the surface water was frozen do not accurately reflect the free water surface elevation and should not be used to evaluate surface water to groundwater connection.

TP/ke

A/R/HIMCO/AA6



MAY 1991

FIGURE 1
SITE LOCATION MAP
(TECHNICAL MEMO)

HIMCO DUMP
SUPERFUND SITE
ELKHART, INDIANA

[illegible]

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DONOHUE

WATER ELEVATION

PROJECT NO. 20026 SITE HIMCO DUMP - INITIAL WELL INVENTORY

WELL NUMBER	ELEVATION OF TOP OF PIPE	DEPTH TO WATER	WATER ELEVATION	DEPTH TO BOTTOM	WELL INTEGRITY LOCKED	CAPPED	CRACKED	OBSTRUCT	COMMENTS [illegible]
E-?	771.11	[illegible]		21.52	X	X			11/6/90 [illegible]
E-[illegible]		[illegible]		[illegible]		X			11/6/90 [illegible] NO PROTECTIVE [illegible]
E-[illegible]		12.[illegible]		[illegible]5.[illegible]	\	X			[illegible] 5" [illegible]
[illegible]		9.[illegible]		[illegible]		X			11/6/90 NOT [illegible]
B-4		[illegible].55'		175.[illegible]'	X	X			11/6/90 NO PROTECTIVE CASING [illegible] EAST)
B-[illegible]		7.34'		130.23	X	X			11/6/90 NO PROTECTIVE CASING 5" ID
[illegible]		[illegible]		[illegible].91'		X			11/6/90 NO PROTECTIVE CASING 2" ID
B-1		11.33'			X	X			11/6/90 NO PROTECTIVE CASING [illegible] WEST)
CP-1	UNABLE TO OPEN					X			11/6/90 NO [illegible]
M-1		[illegible]		103.34		X			11/6/90 [illegible]
M-2		[illegible]		[illegible]		X			11/6/90 [illegible] VENT PLUGGED
L-1		12.58		62.53	X	X			11/6/90 NO PROTECTIVE CASING, VENTED 5" ID. SILTY
L-2		10.46		196.0	X	X			11/6/90 NO PROTECTIVE CASING, VENTED [illegible] SILTY
-4		11.73		18.91		X			11/6/90 NO PROTECTIVE CASING, [illegible] PLUGGED 2" ID [illegible] LOCKING CAP
-3		9.38		22.20	X	X			11/6/90 NO PROTECTIVE CASING, VENTED CAP 5" ID CASING
I-1		10.67		172.82	X	X			11/6/90 NO PROTECTIVE CASING, VENTED CAP 5" ID CASING
I-2		[illegible]		15.64	NO	X			11/6/90 NO PROTECTIVE CASING, VENTED CAP 2" PVC
-1		5.87		23.69	NO	X			11/6/90 UNLOCKED FLUSH MOUNT WELL BOX NEXT TO HYDRANT, ACROSS FROM PAINT SP
[illegible]-1		11.65		42.70	X	X	X		11/6/90 NO PROTECTIVE CASING, VENTED CAP 5" ID PVC
J-3		22.18		153.62	X	X			" "
J-2		9.76		17.80	NO	X			11/6/90 UNLOCKED, 2" ID PVC WELL VENTED CAP
F-2		17.06		147.85	X	X			11/6/90 NO PROTECTIVE CASING, VENTED CAP 5" ID PVC
F-3?		20.34		180.20	X	X			" " [illegible]
F-1?		[illegible]		31.25	NO	X			[illegible] NO PROTECTOR, [illegible]
G-1		13.75		46.27	X	X			11/6/90 NO PROTECTOR VENTED CAP 5" ID PVC CASING
G-3		27.62		—	X	X			" " " UNABLE TO LOCATE TOTAL DEPTH
P-1		8.90		25.24	NO	NO			11/6/90 FLUSH MOUNT WELL BOX, WELL 2" ID AT AN ANGLE
O-1		10.19		29.77	X	X			11/6/90 FLUSH MOUNT WELL BOX WELL 2" ID PVC

DESCRIPTION OF SITE

SOIL CONDITIONS

WEATHER TEMPERATURE

Pg 1 of 2

DONOHUE WATER ELEVATION FEB. 1, 1991

PROJECT NO. 20026 SITE Himco Dump

WELL NUMBER	ELEVATION OF TOP OF PIPE	DEPTH TO WATER (Ft.)	WATER ELEVATION	DEPTH TO BOTTOM (Ft.)	WELL INTEGRITY LOCKED	CAPPED	CRACKED	OBSTRUCT	COMMENTS
B-1	763.63	6.25	757.38		X	X			1052 NO PROTECTIVE CASING
B-2	763.20	6.15	757.05	13.88		X			1055
B-3	764.67	7.44	757.23	130.34	X	X			1059
B-4	763.70	6.45	757.25	175.16	X	X			1110
CP-1	761.19	3.82	757.37	20.19		X			1013 2/2/91 NO PROTECTIVE CASING
E-2	771.15	9.82	761.33	16.54	X	X			~~1507~~ 1612 NO PROT. CAS. AK 2/1/91
E-3	771.11	11.11	760.00	175.65	X	X			1614 2/1/AK NO PROTECTIVE CASING
F-1		7.67		31.28		X			~~1555~~ 1755 NO PROTECTIVE CASING
F-2		14.08		147.53	X	X			1438 NO PROTECTIVE CASING
F-3		16.98			X	X			1453 NO PROTECTIVE CASING
G-1		12.48		52.02	X	X			1413 NO PROTECTIVE CASING
G-3		22.08		169.89	X	X			1424 NO PROTECTIVE CASING (CAP CRACKED)
I-1		9.48		172.93	X	X			1540 NO PROTECTIVE CASING
I-2		8.78		15.67		X			1544
I-3		9.14		32.15	X	X			1832 NO PROTECTIVE CASING
J-1		13.03		42.64	X	X			1514 NO PROTECTIVE CASING (CAP CRACKED)
J-2		10.29		17.81		X	X		1524 NO PROTECTIVE CASING
J-3		18.63		153.39	X	X			1520 NO PROTECTIVE CASING
M-1	770.32	15.61	754.71	103.24		X			1045 2/2/91 (N) NO PROT. CASING
M-2	769.46	14.84	754.62	24.76		X			1050 2/2/91 (S)
N-1		8.81		29.22		X			0947 2/2/91 FLUSH
Q-1		5.0		23.47		X			[illegible] 1820
Q-1	763.33	8.34	754.99	29.77		X			~~0923~~ 0931 AK 2/1/91 [illegible] 2/2/91
WT101A	764.35	9.96	754.39	18.70	X	X			1145
P101B	764.29	9.89	754.40	100.49	X	X			1152
P101C	764.16	9.78	754.38	166.53	X	X			1159
WT106A	761.47	7.87	753.60	18.50	X	X			1558
WT105A	762.94	9.0	753.94	18.56	X	X			1625
WT104A	765.57	8.02	757.55	18.69	X	X			1635
WT103A	760.59	5.28	755.31	18.47	X	X			1001 2/3/91
WT102A	769.08	10.17	758.91	18.18	X	X			0851 2/3/91

DESCRIPTION OF SITE E1 1607 DTW=11.38 DTB=71.15

SOIL CONDITIONS O-1: Flush w/ground water no key cover to [illegible] casing fill w/

WEATHER [illegible] ice water can not [illegible] TEMPERATURE

TECHNICAL MEMORANDUM NUMBER 4

DATE: January 22, 1991

TO: Vanessa Harris, Site Manager

CC: Marcia Kuehl, RI Lead
Roman Gau, Project Manager
Mike Crosser, TSQAM

FROM: Tom Puchalski

SUBJECT: EPA ARCS Region V Contract No. 68-W8-0093
EPA Work Assignment No. 17-5L4J
Donohue Project No. 20026.024
Himco Dump RI/FS

GEOTECH BORINGS

Introduction

Four deep (175-foot) geotech borings were drilled and sampled as described in Exhibit A, Field Sampling Plan Addendum to Volume 2, Field Sampling Plan, Himco Dump Remedial Investigation/Feasibility Study, Elkhart, Indiana. Drilling activities for these borings began on December 17, 1990, and were completed January 9, 1991. These four borings were completed to investigate the site stratigraphy and to collect samples for geotechnical analysis at the Himco Dump Site, Elkhart, Indiana. The boring locations are provided in Figure 1 of this memorandum. Drilling and sampling activities were completed by Max Tinnin and Don Brewington of John Mathes and Associates, Inc. (Columbia, Illinois) with a TH60, Ingersol Rand air/mud rotary rig. Tom Puchalski of Donohue & Associates, Inc., inspected the drilling and sampling, completed time logs, logged all samples, collected select samples for geotechnical analysis, and performed air monitoring using a photoionization detector and gasponder.

Methods

Drilling and sampling were performed as described in Exhibit A, Field Sampling Plan Addendum to Volume 2, Field Sampling Plan, Himco Dump Remedial Investigation/Feasibility Study, Elkhart, Indiana, Section 4.2.

Each geotech boring began with using air rotary and a 7-7/8-inch tricone bit. The boring was blind-drilled to 18 feet. Eight-inch casing was then pounded down into the borehole to 8 or 9 feet. The 8-inch steel casing was then temporarily sealed in-place using granular bentonite. A 3-foot diameter steel casing was installed at the surface with a 6-inch diameter PVC tube extending to a 500-gallon mud tub. After the drilling mud was mixed in the tub, mud rotary drilling began. A 5-7/8-inch blade bit was used for the remainder of Borings 7, 8, and 9. Once this bit was worn out, a 7-7/8-inch blade bit replacement was used to drill Boring 10. Split-spoon sampling was accomplished with a 2-inch O.D., 2-foot long split-spoon sampler passed down through the inside of the drill stem. The split-spoon sampler was driven by a 140-pound down-hole hammer which was operated by a winch at the surface.

The Donohue geologist performed atmospheric monitoring at 5-foot intervals using a photoionization detector and gasponder. The geologist also logged all the samples using the Unified Soil Classification System (U.S.C.S.) based on visual inspection. A Munsell Color Chart was used to describe all soil colors.

The borings were drilled to the following depths: BRG-7, 174.5 feet; BRG-8, 166 feet; BRG-9, 173.5 feet; and BRG-10, 174 feet.

All borings were abandoned by backfilling with cement/bentonite grout emplaced by tremie pipe.

Deviations

The sampling plan specified using a 3-7/8-inch bit, however, either a 5-7/8 or 7-7/8-inch bit was used. The larger bits were required because split-spoon sampling was performed through the inside of the blade bit. Using a larger bit had no effect on the sampling of geotechnical borings.

Although several attempts were made to push shelby tubes, none were successful.

Boring 8 was finished at 166 feet instead of 175 feet because a till aquitard greater than 4 feet thick was encountered. In order to avoid passing through this aquitard at this downgradient location, the hole was stopped after two split-spoons sampled the unit.

Summary of Results

Boring logs, including atmospheric monitoring results, are provided in Appendix A.

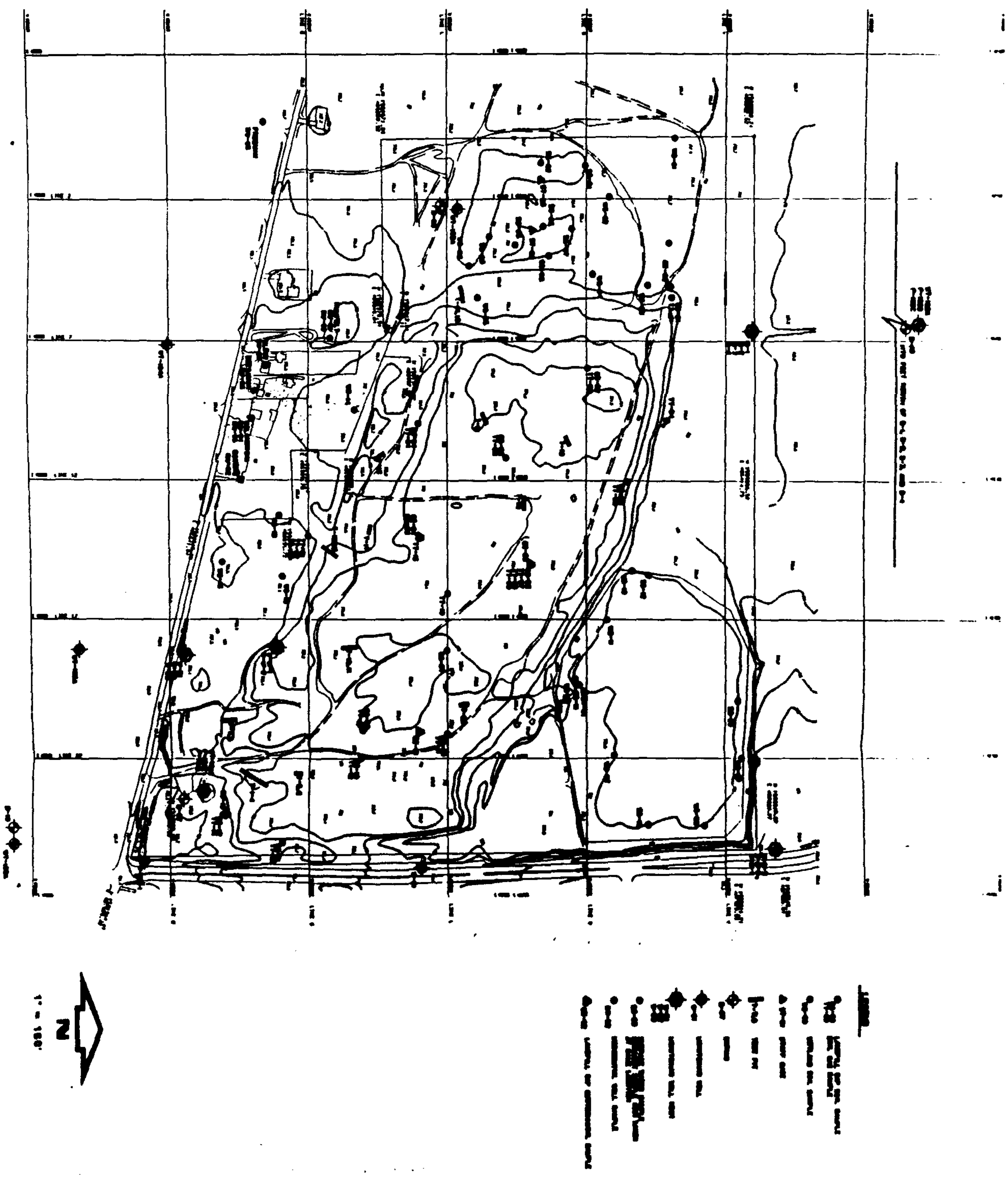
Of the 20 geotechnical and 20 TOC samples sent to the laboratory, 15 geotechnical and 15 TOC samples were collected from the four deep geotech borings. Although three shelby tube samples were also designated to be collected from these four borings, attempts to retrieve these samples were unsuccessful.

Several complications caused delays in the drilling schedule. Some of the difficulties were weather-related. The operation of the drill rig was dependent upon the air system being free of water. Condensation would generally build up overnight which caused pressure losses in the air system. Isopropanol dripped into the lines would eventually clear up this problem. Mud or water freezing in the circulation hoses or in the mud pump also caused delays in the morning while a propane torch was used to thaw frozen parts.

One day of drilling was lost to an equipment failure. One of the main hydraulic hoses ruptured on the drill rig requiring replacement.

TP/ke

A/R/HIMCO/AA7



MAY 1991

FIGURE 1
SITE LOCATION MAP
(TECHNICAL MEMO)

HIMCO DUMP
SUPERFUND SITE
ELKHART, INDIANA

20626

ENGINEERS
ARCHITECTS
SCIENTISTS

APPENDIX A

BORING LOGS

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Engineers & Architects

COMPUTER AIDED DESIGN/DRAFTING

BORING LOG

SOIL BORING NO. BRG-07

SITE: Himco Dump PROJECT NO. 20026.023

DRILLING METHOD: Mud Rotary 3⅞"
20'-175' blade bit - [illegible]
Air rotary 5⅞ tricone 0-20 feet

LOG BY: TOM PUCHALSKI

DRILLER: Max Tinnie Dan Brewington

WEATHER: 40s overcast Matthies

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

60 ft south of P101B

PHYSICAL SETTING: Flat grass field

GROUND SURFACE ELEV.:

COORDINATES:

NORTH:

EAST:

DATE START: 12/16/90

DATE COMPLETE: 12/18/90

WELL INSTALLATION: NONE

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2 / LEL	CO / H_2S
2			Blind drilled first 20 feet with air rotary 7⅞ tricone bit										
4													
6			See log for BRG01 for first 20 feet at this location. 18 [illegible] 12/16/90										
8			← 8" casing to 9 feet-pulled and switched to 8" casing to 19' @ 900 and 45 feet depth										
10													
12													
14													
16			Driller did not count							1450	0	21.3 / 0	0 / 0
18		SM	10YR 5/1, Gray SILTY SAND, 70% fn grn 10% md to co 20% silt trace shells, small grvl, sat OUTWASH					3"SS	18-20'	1645	0	21.5 / 0	0 / 0
20			End of day 12/16/90										
			GEO - 18-19' GT07-C1										
22			Start 12/17/90										
24		SM	10 YR 5/1 Gray SILTY SAND with gravel medium grained 80% Sand, 20% Silt, 2 broken cobbles in spoon > 2" diameter sat OUTWASH	15				3"SS	23-25'	819	0	21.3 / 0	0 / 0
26													
28		GM	OUTWASH 10 YR 5/1 Gray SILTY GRAVEL. 70% ½" dia	31				3"SS	28-30	832	0	21.3 / 0	0 / 0

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COMPUTER AIDED DESIGN/DRAFTING

BORING LOG

SOIL BORING NO. BRG-07

SITE: HIMCO DUMP PROJECT NO. 20026.023

DRILLING METHOD: 3 7/8" ~~[illegible]~~ blade mud rotary, down hole 140 lb hammer on 2" split spoon

LOG BY: TOM PUCHALSKI

DRILLER: MAX TINNIN - MATHES

WEATHER: South wind, 15 mph, overcast

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: Flat grass field

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: 12/16/90
DATE COMPLETE: 12/18/90
WELL INSTALLATION: NONE

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2 / LEL	CO / H_2S
32													
34		GM	10YR 5/1 GRAY SILTY GRAVEL, 70% >2" dia gvl, 20% co-md snd, 10% silt, saturated OUTWASH	30				2"SS	33-35	838	0	21.2 / .007	0 / 0
36													
38		GM	10YR 5/1 Grey SILTY GRAVEL, 85% 1/2->2" dia gravel-sbrd, 20% co-md snd, 10% silt, sat OUTWASH	15				2"SS	38-40	848	0	21.2 / .007	0 / 0
40													
44		GM	POOR RECOVERY, 1/4-1/2" sbrd gvl, some >2" 10% silty sand OUTWASH	14				2"SS	43-45	858	0	21.2 / .006	0 / 0
46			Begin loosing mud at surface due to poor seal at 8" casing/soil interface. Reseal with bentonite. Set up sand filter cone.					50 gallons mud lost down hole					
48		SP	10YR 5/1 Grey SAND, fine grained, sat OUTWASH	35				2"SS	48-50	1059	0	21.2 / .007	0 / 0
50								GEO	48-49	GT07-03			
52													
54		SP	10YR 5/1 Grey SAND, fn grn, sat, trace 1/2" dia sbang gvl scattered throughout, saturated OUTWASH	33				2"SS	53-55	1106	0	21.2 / .009	0 / 0
56													
58			Poorly Graded GRAVEL, 3/4-1 inch diameter	[illegible]				2"SS	58-60	1123	0	21.2	0

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COMPUTER AIDED DESIGN/DRAFTING

BORING LOG

SITE: HIMCO DUMP PROJECT NO. 20076.033

SOIL BORING NO. BRG-07

DRILLING METHOD: 7 7/8" ~~tricone~~ blade mud rotary downhole 140 lb hammer, 2" SS

LOG BY: TEP

DRILLER: MT, DB - JMA

WEATHER: South wind 15mph, overcast

WATER LEVEL READINGS: DATE / TIME / DEPTH / CASING

PHYSICAL SETTING: Flat grassy field.

GROUND SURFACE ELEV.:

COORDINATES: NORTH: EAST:

DATE START: 12/16/90

DATE COMPLETE: 12/18/90

WELL INSTALLATION: NONE

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	N	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2 / LEL	CO / H_2S
62										
64	OUTWASH	SP	10YR 5/1 Gray SAND, fine grained, well sorted, saturated	30	2"SS	63-65	1145	0	20.3 / 0	0 / 0
66										
68	OUTWASH	SP	10YR 6/2 Light Brownish Gray SAND, fine grn well sorted, saturated, one >2" dia. cobble.	50	2"SS	68-70	1324	RAIN - Can't take air readings.		
72			~~10YR 5/1 Gray~~ 73' 1117/90							
74	OUTWASH	SP	10 YR 5/1 Gray SAND, well sorted, fine grained, saturated	44	2"SS	73-75	1334			
78	OUTWASH	SP	10YR 5/1 Gray SAND, fine grained, trace 1/4" silty clay clasts 10YR 6/1 Light gray, saturated	54	2"SS	78-80	1346			
82										
84	OUTWASH	SM	10YR 5/1 Gray SILTY SAND, fn grn, trace 1/4" silty clay 10YR 6/1 Lt gray, sat 20% silt	61	2"SS	83-85	1358			
86										
88		SM	As above ...	44	2"SS	88-90	1414			

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BORING LOG

SITE: HIMCO DUMP   PROJECT NO. 30036.033

SOIL BORING NO. BRG07

DRILLING METHOD: 5"8" hole mud rotary, down hole 140 lb hammer, 2" SS
LOG BY: TEP
DRILLER: MT, DB / Mathes
WEATHER: Raining, south wind 10 mph 40s

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: Grass field

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: 12/16/90
DATE COMPLETE: 12/18/90
WELL INSTALLATION: NONE

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2 / LEL	CO / H_2S
92											Raining		
94		SM	2.5 Y, 5/2 Grayish Brown SILTY SAND, 1 inch stratified zone, interlayered gray silty clay clast silt layers, and silty sand layers - each ~ 1/4" thick, saturated OUTWASH / LACUSTRINE	50				2" SS	93-95	1420			
96													
98		SM	2.5 Y, 5/2 Grayish Brown SILTY SAND, fine grained, 30% silt, low coh, saturated OUTWASH	30				2" SS	98-100	1428			
102													
104		SM	2.5 Y, 5/2 Grayish Brown SILTY SAND, fine grn, 20% silt, low coh, 2-1 inch stratified silt / fn snd zones, saturated OUTWASH/LACUSTRINE	40				2" SS	103-105	1435			
106													
108		SM	2.5 Y 5/2 Grayish Brown SILTY SAND, fn grn, 20% silt, low coh, saturated OUTWASH	50				2" SS	108-110	1445			
110													
112													
114		SP	2.5 Y 5/2 Grayish Brown SAND, fn grained saturated OUTWASH	51				2" SS	113-115	1457	0	20.3 / 0	0 / 0
116													
118											Rain		
		SM	2.5 Y 5/2 Grayish Brown SILTY SAND, fine grn,	41				2" SS	118-120	1513			

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BORING LOG

SOIL BORING NO. BRG07

SITE: HIMCO DUMP PROJECT NO. 20036.023

DRILLING METHOD: 5 7/8 [illegible] bit mud rotary, down hole 140 lb hammer, 2" SS

LOG BY: TOM PUCHALSKI

DRILLER: MT/DB-Mathes

WEATHER: Rain 40s, southwind 7mph

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: Grass Field

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: 12/16/90
DATE COMPLETE: 12/18/90
WELL INSTALLATION: NONE

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2 / LEL	CO / H_2S
122													
124		SP	2.5Y 5/2 Grayish Brn SAND, well sorted, low ick, saturated, fine grained OUTWASH		50			2"SS	123-125	1521	0	21.3/0	0/0
126													
128		SP	AS ABOVE + trace coarse sand - white subangular grains OUTWASH		52			2"SS	128-130	1528	RAIN		
130													
132													
134		SP	2.5Y 5/2 Grayish Brn SAND, fine grained low ick, sat trace coarse sand [illegible] OUTWASH		50			2"SS	133-135	1537			
136													
138		SP	As Above OUTWASH		50			2"SS	138-140	1555			
140													
140													
144		SP	As Above OUTWASH		54			2"SS	143-145	1600			
146													
148		SP	As Above		47			2"SS	148-150	1610			

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BORING LOG

SOIL BORING NO. BRG C7

SITE: HIMCO DUMP PROJECT NO. 20026.023

DRILLING METHOD: 3 7/8 blade bit and rotary 140 lb down-hole hammer, 2" SS

LOG BY: TOM PUCHALSKI

DRILLER: Max Tinnin, Don Brewington

WEATHER: Rain, low 40s, southwind 5 mph

PHYSICAL SETTING: open field

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: 12/16/90
DATE COMPLETE: 12/18/90
WELL INSTALLATION: NONE

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2 / LEL	CO / H_2S
152													
154		SP	2.5Y 5/2 Grayish Brown SAND, fine grained, loose, sat, trace coarse sand - strong		45			2" SS	153-155	1620	0	21.3 / 0	0 / 0
156													
158		SP	As Above		51			2" SS	158-160	1630	Rain		
								GEOTECH	158-158.5	GT07-05			
162													
164		CL	10YR 5/1 Gray SILTY CLAY, medium plasticity, trace 1/4" shrd gvl, moist		36			3" SS	163-165	1646			
			TILL					GEOTECH	163-164	GT07-06			
166													
168		SM SP	10YR 2.5Y 5/2 Grayish Brn SILTY SAND with gvl 1/2" 2.5Y 5/2 Grayish Brn SAND, Fine grained saturated		39			2" SS	168-170	1700			
170			OUTWASH										
			HARD DRILLING AT 171'										
172													
174		ML ML	2.5Y 5/2 Grayish Brn SILT, low, dense, moist trace 1/2" subrounded gravel TILL	for 1 foot	60			2" SS	173-175	1705			
			12/17/90 drilled to 174, took additional spoon 174-174.5					2" SS	174-174.5	1728			
			EOB Drilled to 179; split spoon to 173.5'					GO	174-174.5	1728	GT07-07		
174	EOB	1705 1730	12/17/90 Tom Puchalski										

12/18/90 9:26 - Push Shelby tube at 174 feet. Tube and AW rod... ...down hole - grouted with cement/bentonite for abandonment

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BORING LOG

SITE: HIMCO DUMP PROJECT NO. 20036.023

SOIL BORING NO. B2G08

DRILLING METHOD: 8" casing to 20 feet. 5 7/8 blade bit & mud rotary 20-175 feet

LOG BY: TOM PUCHALSKI

DRILLER: Mike Tinnin/Dan Brewington - Mathes

WEATHER: Clear 30°F South wind Smoke

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: 60 ft south of 103

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: 12/19/90
DATE COMPLETE:
WELL INSTALLATION:

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O2/LEL	CO/H2S
2			Blind drill with air rotary										
4			See log for WT103A for first 20 feet										
6		8" casing to 9 feet											
8–16										1043	0	21.3/0	0/0
18–20		SW	10YR 5/1 Gray Gravelly Sand, 40% strong med grn sand, 30% coarse sand, 30% shot & strong small gravel, saturated. OUTWASH	39				3"SS	18-20	1220	0	21.3/0	0/0
			GEOTECH - GT08-01 18-19'										
24		GP(?)	RECOVERED ONE 3" COBBLE IN SPOON TIP	15				3"SS	23-25	1231	0	21.0/0	0/0
28		SW	10YR 5/1 Gray GRAVELLY SAND, 40% strong coarse grn sand, 30% med grn, 30%	33				3"SS	28-30	1243	0	21.3/0	0/0

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BORING LOG

SOIL BORING NO. BRG08

SITE: HIMCO DUMP PROJECT NO. 20026.023

DRILLING METHOD: See page 1
LOG BY: TOM PUCHALSKI
DRILLER: See page 1
WEATHER: "

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: "

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: 12/19/96
DATE COMPLETE:
WELL INSTALLATION:

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2/LEL	CO/H_2S
30													
32													
34		SP	2.5Y 5/2 Greyish Brown SAND, medium grn trace sbang coarse sand, trace sbang gvl, saturated OUTWASH		33			2"SS	33-35	1249	0	21.3/0	0/0
36													
38		GW	2.5Y 5/2 Grayish Brown GRAVEL; 1/8"-1/2" angular & sbang, trace medium sand, sat OUTWASH		25			2"SS	38-40	1255	0	21.2/0	0/0
40													
42													
44		GW	GRAVEL, most broken > 2", green volcanics, dolomite saturated OUTWASH		15				43-45	1305	0	21.3/0	0/0
46													
48		GW	well graded GRAVEL 30% fine sand 70% 1/8-1" gvl, some > 2" saturated OUTWASH		45				48-50	1311	0	21.1/0	0/0
50													
52													
54		SP	2.5Y 5/2 Grayish Brown SAND, Fine grn trace medium sand, saturated non cohesive, non plastic OUTWASH		40				53-55	1318	0	21.3/0	0/0
56													
58									58-6[illegible]	1325	0	21.5/[illegible]	[illegible]

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COMPUTER AIDED DESIGN/DRAFTING

BORING LOG

SITE: HIMCO DUMP PROJECT NO. 20036.023

SOIL BORING NO. BRG08

DRILLING METHOD: See pg 1

LOG BY: TEP
DRILLER: See pg 1
WEATHER: Snow, 18°F, west wind 2mph

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: See pg 1

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: 12/19/90
DATE COMPLETE:
WELL INSTALLATION: NONE

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2 / LEL	CO / H_2S
60			Start 1145 1/3/91										
62													
64		GW	WELL GRADED GRAVEL > 3" Broken in tip - green mafic volcanic - basalt most 3/4" sbrd OUTWASH		50			2"SS	63-65	1342	0	21.3 / 0	0 / 0
								TOC08-01	63-63.5				
66													
68		SP	10YR 6/2 LT brownish grey SAND, well sorted fine grained, nonplas, low coh, sat OUTWASH		3			2"SS	68-70	1353	0	21.3 / 0	0 / 0
								TOC08-02	68-68.5				
70													
72													
74		SP	10 YR 5/2 Grayish Brown SAND, well sorted fn grained, non plas, low coh, sat [illegible] angular white mineral - Sodic plagioclase or chert(?) OUTWASH		65			2"SS	73-75	1400	0	21.3 / 0	0 / 0
								TOC08-03	73-73.5				
76													
78		SP	As above OUTWASH		10			2"SS	78-80	1410	0	21.3 / 0	0 / 0
								TOC08-04	78-78.5				
80													
82													
84		SP	Same as above OUTWASH		41			2"SS	83-85	1420	0	21.3 / 0	0 / 0
								TOC08-05	83-83.5				
86													
			8.5" zone of silt/clay lenses										
88		SM	10YR 5/2 Grayish Brn SILTY SAND 20% silt 80% [illegible]		[illegible]			2"SS	88-90	14[illegible]	0	20.[illegible]	0 / 0

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BORING LOG

SOIL BORING NO. BRG08

SITE: HIMCO DUMP PROJECT NO. 20036.023

DRILLING METHOD: See pg. one
LOG BY: TEP
DRILLER: See Pg one
WEATHER: See page three

WATER LEVEL READINGS: DATE / TIME / DEPTH / CASING

PHYSICAL SETTING: See Pg. 1

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: 12/19/90
DATE COMPLETE:
WELL INSTALLATION: None

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2 / LEL	CO / H2S
90													
92													
94		SP	10YR 5/2 Grayish Brown SAND: fine grained, well sorted, non coh, sat OUTWASH		41			2" SS	93-95	1451	0	21/0	0/0
									GT08-03	93-93.5			
96													
98			NO RECOVERY		50			2" SS	98-100	1500	0	21.0/0	0/0
100													
102													
104		SP	10YR 5/2 Grayish Brown SAND, coarse mixed with lens and fe grading w/ ll fine grained, low coh, nonplas, sat OUTWASH		50			2" SS	103-105	1510	0	19.0/0	0/0
106													
108		SP	As above but all fine grained OUTWASH		50			2" SS	108-110	1519	0	20/0	0/0
110													
112													
114		SP	As Above OUTWASH		50			2" SS	113-115	1526	0	20.3/0	0/0
116													
118													

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BORING LOG

SOIL BORING NO. BR609

SITE: HINCA DUMP PROJECT NO. 20026.023

DRILLING METHOD: See pg. one

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:

LOG BY: TEP
DRILLER: See pg one
WEATHER: See pg three

PHYSICAL SETTING: See pg one

DATE START: 12/6/00
DATE COMPLETE:
WELL INSTALLATION: NONE

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	S	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2 / LEL	CO / H_2S
120													
122													
124		SP	10YR 5/2 Grayish Brown SAND, finegrained, nonplas, low coh, sat. Very fine grained - almost silt stratification occassional, trace organic debris in stratification < 1% OUTWASH	50				2"SS	123-125	1555	0	19.9 / 0	0 / 0
126													
128		SP	10YR 5/2 Grayish Brown SAND, well sorted, fine grained, low coh, non plas, sat OUTWASH	50				2"SS	128-130	1605	0	20.1 / 0	0 / 0
130													
132													
134		SP	As above	50				2"SS	133-135	1631	0	21.0 / 0	0 / 0
136	~?~												
138		GW	Well graded Gravel with sand, most gvl >2" (broken in spoon) some 1", sand fine grained, saturated OUTWASH	50				2"SS	138-140	1641	0	19.9 / 0	0 / 0
140													
142		GP	Poorly graded GRAVEL, most 1/4" sized, 15% fn grn sand, OUTWASH	50				2"SS	143-145	1653	0	20.0 / 0	0 / 0
144								GT08-c4	143-143.5				
146													
148			Poorly graded Gravel ...										

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BORING LOG

SOIL BORING NO. BRG08

SITE: HIMCO DUMP PROJECT NO. 20026.033

DRILLING METHOD: See pg 1

WATER LEVEL READINGS: DATE / TIME / DEPTH / CASING

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:

LOG BY: TEP
DRILLER: See pg 1
WEATHER: See pg Himco

DATE START: 12/19/90
DATE COMPLETE:
PHYSICAL SETTING: See pg one
WELL INSTALLATION: NONE

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2 / LEL	CO / H_2S
150									
152									
154		GR	Poorly graded GRAVEL 30% fn gray sand, most gravel > 2" (broken in spoon) OUTWASH	2" SS	153-155	1707	0	21.0 / 0	0 / 0
156									
158		SM	Gray silty clay layered with fn gray silty sand 10YR 5/2 Grayish Brown SILTY SAND, fine grained, 20% silt, moist OUTWASH	2" SS	158-160	1722	0	20.0 / 0	0 / 0
160									
162									
164		ML	10YR 5/2 Grayish Brown SILT, trace clay, moist trace ½" subang gvl TILL	2" SS	163-165	1740	0	21.0 / 0	0 / 0
				GEOTECH	GTC805	1740	163-164		
166				2" SS	165-167	1749	0	20.0 / 0	0 / 0
		ML	10 YR 4/2 Dark Grayish Brown SILT, trace clay, trace subang gvl ⅛", moist TILL						
168					~~168-170~~ SEP				
170			EOB 1/3/91 1740 Tom Puchalski						
			Split Spoon to 166, drilled 7⅞ bit to 165' 5⅞ SEP						
172									
174					~~173-175~~ SEP				
176									

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BORING LOG

SITE: HIMCO DUMP PROJECT NO. 20036.023

SOIL BORING NO. BRGC9

DRILLING METHOD: 7⅞ tricone & air to 18 feet 5⅞ blade bit & mud rotary - remainder of boring

LOG BY: TOM PUCHALSKI

DRILLER: Mac Timmin / Dan Brewington Mathews

WEATHER: Snow, 32°F, west wind South

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: 60 ft south of 102 west at woods edge

GROUND SURFACE ELEV.:

COORDINATES:

NORTH:

EAST:

DATE START: January 5, 1991

DATE COMPLETE:

WELL INSTALLATION: NONE

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2 / LEL	
2			Blind drill with air to 18 feet See log for WT102A for first 18 feet.										
4													
6													
8													
10													
12													
14													
16													
18			START 1400 1/5/91										
		SP	10 YR 5/3 Brown, SAND, poorly sorted, coarse grained, sat, trace grvl, trace med sand OUTWASH	18				3"SS TOC09-01	18-20 18-19	1400	0	20/0	0/0
20													
22													
		SP	10 YR 5/3 Brown SAND, fn grained, sat, sampled OUTWASH	35				3"SS TOC09-03	23-25 23-23.5	1404	0	20.3/0	0/0
24													
26													
28		SP	10 YR 5/3 Brown SAND 30% fine 70% med,	35				3"SS	28-30	1414	0	20.3/0	0/0

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BORING LOG

SOIL BORING NO. B-G09

SITE: HIMCO DUMP PROJECT NO. 20006.022

DRILLING METHOD:

LOG BY:
DRILLER:
WEATHER:

WATER LEVEL READINGS: DATE / TIME / DEPTH / CASING

PHYSICAL SETTING:

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: 1/5/91
DATE COMPLETE:
WELL INSTALLATION: NONE

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	N	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2 / LEL	CO / H_2S
30–32										
33–35		SP	10 YR 5/3 Brown SAND, fine grained, sat trace small sbang gvl. OUTWASH	25	2"SS	33-35	1420	0	21.2 / 0	0 / 0
					TCC09-04	33-33.5				
38–40		GP	Poorly graded GRAVEL, trace fine sand, most gvl >2" diam, broken in spoon OUTWASH	25	2"SS	38-40	1425	0	21.0 / 0	0 / 0
43–45		GP	Poorly graded GRAVEL, most sbrd, some sbang 3/4", basalt, dolomite, chert OUTWASH NO SAND	36	2"SS	43-45	1433	0	20.3 / 0	0 / 0
48–50		GP	Poorly graded GRAVEL, ≤ 1" sbang 10% fn grn Sand, sat OUTWASH	40	2"SS	48-50	1441	0	21 / 0	0 / 0
					TCC09-05	48-48.5				
53–55		SP	10YR 5/3 Brown SAND, poorly graded, fn grn, trace 1" gvl sbang, qtzite, sat OUTWASH	16	2"SS	53-55	1449	0	20 / 0	0 / 0
					GTC09-01	53-53.5				
58–		SP	10YR 5/3 Grayish Brown SAND, 20% 1" sbang	25	2"SS	58-60	1457	0	20 / 0	0 / 0

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BORING LOG

SOIL BORING NO. GG09

SITE: HIMCO DUMP PROJECT NO. 30026.023

DRILLING METHOD: See page 1

LOG BY: TOM PUCHALSKI

DRILLER: JMA

WEATHER: See page 1

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: Page 1

GROUND SURFACE ELEV.:

COORDINATES:

NORTH:

EAST:

DATE START: 1/5/91

DATE COMPLETE:

WELL INSTALLATION:

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O2/LEL	
62													
64		SP	10YR 5/2 Grayish Brown SAND, noncoh, non plas, fine grained, sat OUTWASH		40			2"SS GT09-02	63-65 63-63.5	1527	0	20.3/0	0/0
66													
68		SP	As above OUTWASH		28			2"SS GT09-03	68-70 68-68.5	1537	0	21.3/0	0/0
70													
72													
74		SP	As above OUTWASH	8"	50			2"SS	73-75	1544	0	21.3/0	0/0
76	~?~												
78		SW	10YR 5/2 Grayish Brown GRAVELLY SAND, noncoh, non plas, sat 10/60/30 Fn/md/cs sand 60% 40% grvl ½" sticky OUTWASH	8"	60			2"SS	78-80	1554	0	21.3/0	0/0
80													
82	~?~		Driller feels change										
84		CL SP	5Y 5/2 Olive grey SILTY 5Y 5/1 Gray SAND, fine grained-close to silt low coh, non plas, sat OUTWASH					2"SS	83-85	1610	0	21.3/0	0/0
86													
88		SP	5Y 4/3 Olive grey SAND as above	6"	75			2"SS	88-90	1625	0	21.3/0	0/0

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BORING LOG

SITE: HIMCO DUMP PROJECT NO. 20036.023

SOIL BORING NO. PPG00

DRILLING METHOD: ____
Sup ___
LOG BY: Paige Gray
DRILLER: ____
WEATHER: Overcast, 34°F

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: ____

GROUND SURFACE ELEV.: ____
COORDINATES: ____
NORTH: ____
EAST: ____
DATE START: ____
DATE COMPLETE: ____
WELL INSTALLATION: ____

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2/LEL	
90		C	5Y 4/3 Olive Gray SILTY CLAY, stratified 1/8" apart, moist, low plas LACUSTRINE										
92													
94		CL		30				2"SS	93-95	1644	0	21.3/0	0/0
96			Attempt Shelby Tube 95-97 1745 - No Recovery in Tube START 930 1/6/91										
98		CL	NO RECOVERY CL in spoon tip SILTY CLAY LACUSTRINE	35				2"SS	98-100	953	0	21.3/0	0/0
102													
104		CL	10Y 4/1 Dark Gray SILTY CLAY, med plas, med coh, non stratified, wet LACUSTRINE	12				2"SS	103-105	1005	0	21.1/0	0/0
106													
108		SP	5Y 4/2 Olive gray SAND, 80% fine grained, 20% medium grain, subangular. sat OUTWASH					2"SS	108-110	1010	0	21/0	0/0
110													
112													
114		CL	5Y 4/1 Dark Gray SILTY CLAY, med plas, med coh, non stratified, wet changes color to 2.5Y 5/2 Grayish Brown SILTY clay OUTWASH	17				2"SS	113-115	1023	0	21.2/0	0/0
116													
118			2.5Y 5/2 Grayish Brown SILT, trace fn					2"SS	118-120	1034	0	21.3	

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BORING LOG

SOIL BORING NO. RBG09

SITE: HIMCO DUMP PROJECT NO. 20036 022

DRILLING METHOD: ___ C. ___ Eye D.

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

GROUND SURFACE ELEV.: ___
COORDINATES: ___
NORTH: ___
EAST: ___

LOG BY: Roger Orr
DRILLER: ___
WEATHER: Sun, pale, Four

PHYSICAL SETTING: Prairie Orr

DATE START: Jan 5, 1991
DATE COMPLETE: ___
WELL INSTALLATION: ___

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2 / LEL	
120													
122													
124		CL	5Y 4/1 Dark Gray SILTY CLAY, med plas, med coh, non stratified, wet LACUSTRINE	20				2" SS	123-125	1040	0	21.3 / 0	0
126			5										
128		SM	5Y 5/2 Olive Gray SILTY SAND, non plas, low coh, 80% fn sand 15% silt 5% ¼" slicing grl, non stratified TILL	30				2" SS	128-130	1049	0	21.3 / 0	0 / 0
130													
132													
134		ML SP ML SP ML	10YR 5/6 Yellowish Brown SAND, fine grained, non coh, moist - in 1" thick cross-bedded layers with 10YR 4/2 Dark Grayish Brown ~~SILTY SAND~~ ~~CLAY~~ SILT, non plas, moist, low coh OUTWASH	35				2" SS	133-135	1058	0	21.3 / 0	0 / 0
136													
138		SP	10YR 5/3 Brown SAND, fine grained, low coh, non plas, sat OUTWASH	30				2" SS	138-140	1105	0	21.4 / 0	0 / 0
140													
142													
144		SM	5Y 4/2 Olive Gray SILTY SAND 75% fn gr sand 10% ¼" slicing grl, 15% silt med coh, non plas, moist TILL.	30 40				2" SS GT09-CL	143-145 143-143.5	1120	0	21.3 / 0	0 / 0
146													
148		SM	As Above	50				2" SS	148-150	1130	0	21.3 / 0	0 / 0

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COMPUTER AIDED DESIGN/DRAFTING

BORING LOG

SITE: HIMCO DUMP PROJECT NO. 20036.033

SOIL BORING NO. SB-C9

DRILLING METHOD: See Page One

LOG BY: See Page One

DRILLER:

WEATHER: See Page Four

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: See pg 1

GROUND SURFACE ELEV.:

COORDINATES:

NORTH:

EAST:

DATE START: Jan 5, 1991

DATE COMPLETE: Jan 6, 1991

WELL INSTALLATION: NONE

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2/LEL	
150													
152													
154		ML	10YR 5/4 Yellowish Brown SILT, stratified with color changes to 7.5Y 5/6 Strong Brown low coh, non plas, moist LACUSTRINE	2"	50			2"SS	153-155	1143	0	21.4/0	0/0
156													
158		SP	5Y 5/2 Olive gray SAND, well sorted, fine grained, sat; stratified LACUSTRINE	3"	60			2"SS	158-160	1155	0	21.0/0	0/0
160													
162													
164		ML	5Y 5/2 Olive Gray SILT, low coh, non plas, moist, stratified LACUSTRINE		53			2"SS	163-163.5	1300	0	21.1/0	0/0
								GTC9-07	163-163.5				
166													
168		SP	5Y 5/2 Olive Gray SAND, non coh, non plas fine grn, sat OUTWASH		55			2"SS	168-170	1320	0	21.6/0	0/0
170													
172													
174		SP	5Y 5/2 Olive Gray SAND, non coh, non plas, fine grained, sat OUTWASH		50			2"SS	173-173.5	1331	0	21.1/0	0/0
								GTC9-08	173-173.5				
		EOB	1330 1/6/91 Split spoon to 173.5 3 7/8 blade bit to 173.0 Tom Puchalski										
176													

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BORING LOG

SOIL BORING NO. RRG10

SITE: HIMCO DUMP PROJECT NO. 20026.023

DRILLING METHOD: 7 7/8 tricone with air rotary to 18 feet, 7 7/8 blade bit & mud rotary to end of boring

LOG BY: TOM PICHALSKI

DRILLER: John Mathes & Assoc. Inc.

WEATHER: 19°F, clear, NE wind Drizzle

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

GROUND SURFACE ELEV.:

COORDINATES:

NORTH:

EAST:

DATE START: Jan 7, 1991

DATE COMPLETE:

PHYSICAL SETTING: 60 feet west of WT106A grass at woods edge

WELL INSTALLATION: NONE

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2/LEL	CO/H_2S
0–18			Blind drill to 18 feet with 7 7/8" tricone & air rotary. See log for WT104A for first 18 feet.										
18			Start 1000 1/8/91										
18–20		SP	10YR 3/2 Greyish Brown GRAVELLY SAND 70% med to coarse grained subrounded sand, 30% 2 subangular gravel, non cohesive, non plastic, saturated; 5% > 20 gravel. OUTWASH	15				2" SS; TOC 10-01	18-20	1011	0	20.9/0	0/0
24		SP	10YR 3/2 Greyish Brown SAND, fine grained, non coh, non plas, saturated. OUTWASH	21				2" SS; TOC 10-02	23-25; 23-23.5	1038	0	20.9/0	0/0
28–30		SP	10YR 4/2 Dark Greyish Brown SAND, fine gr, ... trace ...	24				2" SS	28-30	1156	0	20.9/0	0/0

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BORING LOG

SOIL BORING NO. BRGIC

SITE: HIMCO DUMP PROJECT NO. 20026.023

DRILLING METHOD: See Page One

LOG BY: See Page One

DRILLER:

WEATHER: See page one

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: Pg One

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: Jan 2 1991
DATE COMPLETE:
WELL INSTALLATION: NONE

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2/LEL	CC/H_2S
32													
34			NO RECOVERY 2" Subangular cobble in nose	18				2"SS	33-35	1215	0	21.1/0	0/0
36													
38		GP	GRAVEL, most > 2" - broken stone, some 1"-3/4", basalt, dolomite predominant, OUTWASH	40				2"SS	38-40	1345	0	21.1/0	0/0
								GT IC-01	38-39				
42													
44		GP	GRAVEL As above OUTWASH	42				2"SS	43-45	1434	0	21.1/0	0/0
46													
48		CL	5Y 4/1 Dark Grey SILTY CLAY, low plasticity, low cohesion, saturated LACUSTRINE	13				2"SS	48-50	1443	0	21.0/0	0/0
50								GT IC-02, TCC IC-04	48-50				
52		SP	5Y 4/1 Dark Grey SAND, well sorted, fine grained, non calc, saturated, very fine grained - non silt size OUTWASH	31				2"SS	53-55	1450	0	20.6/0	0/0
54								TCC IC 05	53-54				
56													
58			As above										

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BORING LOG

SOIL BORING NO. RRG10

SITE: HIMCO DUMP PROJECT NO. 20036.023

DRILLING METHOD:

LOG BY:

DRILLER:

WEATHER: Overcast SE wind 12, 30°F

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: Page 1

GROUND SURFACE ELEV.:

COORDINATES:

NORTH:

EAST:

DATE START: Jan 2, 1991

DATE COMPLETE:

WELL INSTALLATION: NONE

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2 / LEL	CO / H_2S
60													
62													
64		SP	5Y 4/1 Dark Grey SAND, fine grained, well sorted, low coh, non plas, saturated very fine grained - near silt size OUTWASH		30			2"SS	63-65	1507	0	21.0 / 0	0 /
66													
68			NO RECOVERY		50			2"SS	~~68-70~~ 68-69	1528	0	21.0 / 0	0 / 0
70													
72													
74		SP	5Y 5/2 Olive Grey, SAND, fine grained, low coh, saturated OUTWASH		41			2"SS GTIC-03	73-75 73-74	1540	0	21.0 / 0	0 / 0
76													
78		SP	2.5Y 5/2 Grayish Brown SAND, fine grained, low coh, non plastic, saturated OUTWASH		40			2"SS	78-80	1548	0	21.0 / 0	0 / 0
80													
82													
84		SP	Same as above OUTWASH		39			2"SS	83-85	1557	0	21.0 / 0	0 / 0
86													
88		SP	As above OUTWASH		40			2"SS	88-90	1603	0	21.0 / 0	0 / 0

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BORING LOG

SITE: HIMCO DUMP PROJECT NO. 20036.073

SOIL BORING NO. SBG10

DRILLING METHOD: See Page One
LOG BY: See Page Three
DRILLER:
WEATHER:

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING:

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: Jan 7, 1991
DATE COMPLETE:
WELL INSTALLATION: NONE

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2/LEL	CO/H_2S
90													
92													
94		SP	2.5Y 5/2 Grayish Brown SAND, fine grained, non coh, non plastic, saturated OUTWASH		40			2"SS	93-95	1615	0	21/0	0/0
96													
98		SP	Same as above		40			2"SS	98-100	1625	0	21/0	0/0
100													
102													
104		SP	2.5Y 5/2 Grayish Brown SAND, fine grained, trace md grn, non coh, saturated OUTWASH		50			2"SS	103-104	1630	0	21.1/0	0/0
106													
108		SP	2.5Y 5/2 Grayish Brown SAND, fine grained trace coarse grained subangular white grains, non coh, sat OUTWASH		50			2"SS	108-110	1645	0	21.1/0	0/0
110													
112													
114		SP	Same as above OUTWASH		43			2"SS	113-114	1655	0	21.1/0	0/0
116													
118													

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Engineers & Architects
COMPUTER AIDED DESIGN/DRAFTING

BORING LOG

SITE: HIMCO DUMP PROJECT NO. 20026.023

SOIL BORING NO. RRG10

DRILLING METHOD: See Page One

LOG BY:

DRILLER:

WEATHER: 28°F, mist+snow, NE wind 5mph

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: Page One

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: Jan 7, 1991
DATE COMPLETE: Jan 9, 1991
WELL INSTALLATION: NONE

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O2/LEL	CO/H2S
120													
122			Start 1/9/91 910										
124		SP	10YR 5/3 Brown SAND, well sorted, fine grained, noncoh, nonplas, saturated OUTWASH		35			2"SS	123-125	920	0	21.2/0	0/0
126													
128		SP	As above OUTWASH		34			2"SS	128-130	934	0	21.6/0	0/0
130													
132													
134		SP	As above OUTWASH		35			2"SS	133-135	939	0	21.1/0	0/0
136													
138		SP	As above + trace angular white mineral - fine grn OUTWASH		35			2"SS	138-140	950	0	21.1/0	0/0
140													
142													
144		SP	10YR 5/3 Brown SAND, well sorted, 80% fine grained, 20% medium grn, noncoh, nonplas, saturated OUTWASH		30			2"SS	143-145	956	0	21.1/0	0/0
146													
148													
150		SP SL	10YR 3/3 Brown SAND, fine grn, noncoh, nonplas [illegible] alternating with 1" to ½" thick layers		31			2"SS	148-150	1006	0	21.1/0	0/0

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COMPUTER AIDED DESIGN/DRAFTING

BORING LOG

SOIL BORING NO. R3G10

SITE: HIMCO DUMP PROJECT NO. 20036.093

DRILLING METHOD: See Page One

LOG BY:

DRILLER:

WEATHER: Page Five

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: Page One

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: Jan 7, 1991
DATE COMPLETE: Jan 9, 1991
WELL INSTALLATION: NONE

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2/LEL	CO/H_2S
152													
154		SP	5Y 5/2 Olive Gray SAND, fine grained - near silt size, stratified, low coh, non plas, saturated LACUSTRINE	21				2"SS	153-155	1012	0	21.1/0	0/0
156													
158		CL	2.5 YR 5/2 Grayish Brown SILTY CLAY, med plas, med coh, soft	15				2"SS	158-160	1021	0	21.1/0	0/0
		SM	2.5 YR 5/2 Grayish Brown SILTY SAND, fine grained, low coh, non plas, saturated ~~40% silt 60% sand~~ LACUSTRINE					GEOTECH	GT04 158-159.5				
160													
162													
164		SM	2.5 YR 5/2 Grayish Brown, SILTY SAND, 60% fine grained qtz sand, 30% silt, 15% clay, trace "e" shaped ? low coh, non plas, saturated LACUSTRINE	20				2"SS	163-165	1032	0	21.1/0	0/0
166													
168		CL	10YR 4/1 Dark Grey SILTY CLAY, med plas, med coh, stratified, moist LACUSTRINE	20				2"SS	168-170	1040	0	21.1/0	0/0
170													
172													
174		ML	10YR 4/1 Dark Grey SILT non plas, med coh, non stratified, moist LACUSTRINE	10				2"SS	173-175	1046	0	21.1/0	0/0
								GT05	173-174				
			EOB Split spoon to 174 drill 7 1/4 to 175 1/9/91 1050 Greg Fuchalski										
176													

TECHNICAL MEMORANDUM NUMBER 5

DATE: April , 1991

TO: Marcia Kuehl

CC: Bob Isenberg
Mansour Ghiasi

FROM: John Cicone

SUBJECT: EPA ARCS Region V Contract No. 68-W8-0093
EPA Work Assignment No. 17-SL4J
Donohue Project No. 20026.025
HIMCO Landfill RI/FS

PRELIMINARY

GEOTECHNICAL DATA EVALUATION

Introduction

The objective of this data evaluation is to determine if the data provided from laboratory consolidation and triaxial shear tests, Atterberg limits, grain size and permeability is sufficient enough for use in Remedial Investigation (RI) and Feasibility Study (FS) reports for the HIMCO Landfill.

Analytical Results

The following table shows the tests for which data was provided and a summary of the results.

LABORATORY TEST	RESULTS
Triaxial Shear	Cohesion (c) = 7 psi = 1008 psf friction angle (ø) = 33°
Atterberg Limits	See Table 1 (attached)
Grain Size	30 Curves total
Consolidation	Unable to obtain results with given data (see Geotechnical Data Interpretation)

Geotechnical Data Interpretation

Data provided for the triaxial shear testing was sufficient to obtain cohesion and friction angle values. The attached figure shows the Mohr-Coulomb failure envelope plotted by the laboratory and the tangent line drawn by Donohue to obtain cohesion (c) and friction angle (ø) values.

Data provided for grain size and Atterberg Limits was complete and require no additional interpretation.

No permeability tests were performed, which would be necessary to determine drainage paths and velocities of contaminated liquids.

Data was provided for a consolidation test. The consolidation coefficient, c_v, which is used to determine how long consolidation will take, can normally be determined from this test. However, c_v cannot be obtained with the data provided. All of the data curves seem to indicate the specimens had not reached 100% consolidation when the test was stopped. Two possible conclusions can be drawn from this termination. The first is that the test was stopped too early resulting in an incomplete curve and c_v cannot be calculated. The second is that the material may have undergone a very rapid consolidation and c_v could only be obtained with some difficulty and accuracy would be limited. The grain size curve for the consolidation test sample indicated a clayey silt, which does not normally have a rapid consolidation. Therefore, the second possibility seems less likely; however, definite conclusions cannot be made with available information.

Data was also provided for the consolidation test to allow for calculation of the compression index, C_c. This value is used to determine the magnitude of consolidation settlement. This value cannot be obtained because the x-axis is labeled improperly as ELAPSED TIME (min) when it should be labeled as a load or pressure (see attached figure).

<u>Summary</u>

The triaxial shear, Atterberg limit and grain size data were sufficient to obtain strength parameters, and to establish soil classifications of the on-site soil.

No permeability test data was provided with the laboratory results and should be obtained if drainage of material beyond site boundaries is a concern.

Consolidation test information was insufficient to calculate c_v and C_c. The laboratory should be contacted to determine why testing was stopped and to relabel the appropriate graph. Further, the laboratory should, as a matter of common practice, provide the c_v and C_c values.

Attachments - Atterberg Limits Results
- Triaxial Shear Test Results
- Compression Index Curve

B/FAIR/AI4

TABLE 1

SUMMARY

OF

LABORATORY TEST RESULTS

PROJECT : SAS 5993E

TETC NO. : 91-220-3106

PROJECT NO. : SAS 5993E

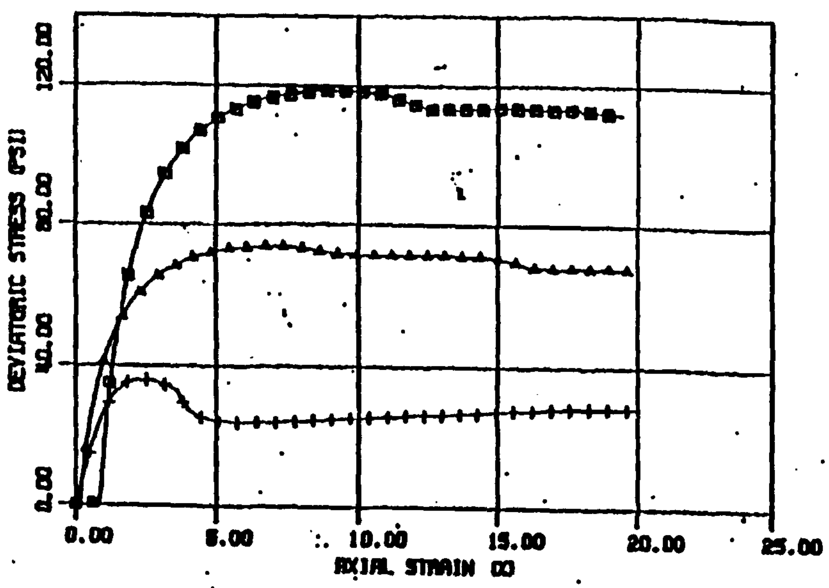
CLIENT : VIAR COMPANY

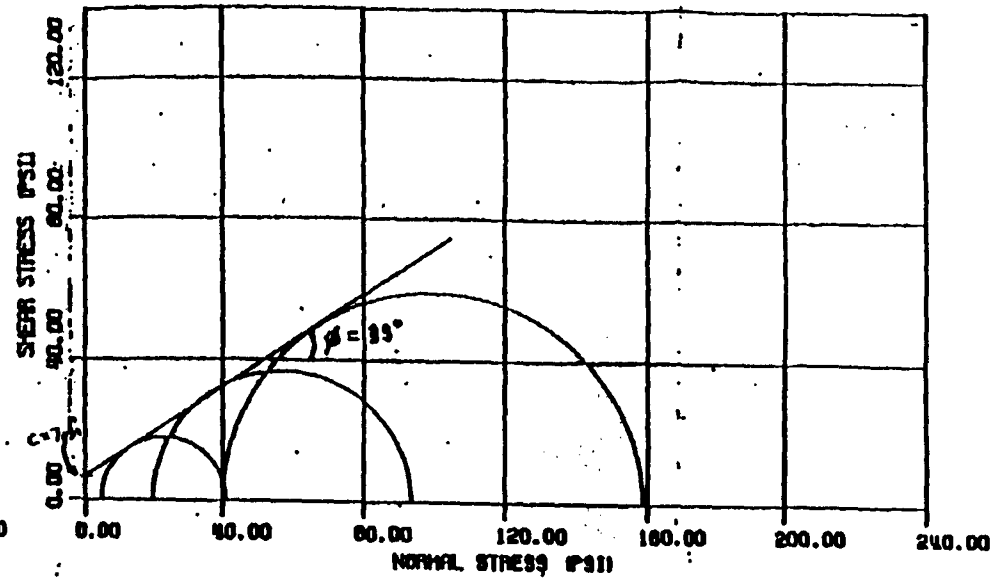
REPORT DATE Feb. 19, 1991

SUMMARIZED BY: S. Seyawatana

LABORATORY MANAGER : (Arul) K. Arulmoli

BORING & SAMPLE NO.	ATTERBERG LIMITS (ASTM D 4318)		
	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)
HDGT-07-06-01	21	12	9
HDGT-07-07-01	17	13	4
HDGT-08-05-01	16	11	5
HDGT-08-06-01	14	11	3
HDGT-08-07-01	23	14	9
HDGT-10-04-01	21	13	8
HDGT-10-06-01	24	17	7





SYMBOL	BORING NO.	SAMPLE NO.	DEPTH (FT)	SAMPLE TYPE	SOIL TYPE	TEST TYPE	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	EFF. CONF. PRESSURE (PSI)	MAX DEV. STRESS (PSI)	STRAIN RATE (%/MIN)	BACK PRESSURE (PSI)
□	[illegible]	[illegible]	32	TUBE		UU	87.8	31.3	40.0	116.8	0.000	0.0
△	[illegible]	S-00003	32	TUBE		UU	78.8	46.8	20.0	73.0	0.000	0.0
+	[illegible]	S-00003	32	TUBE		UU	58.5	86.0	5.0	36.0	0.000	0.0

PROJECT: SAS993E
PROJECT NUMBER: 91ZD03

The Earth Technology Corporation

TRIAXIAL TEST RESULTS
TEST TYPE: UU

CONSOLIDATION TEST RESULTS
(ASTM D2435)

PROJECT: SAS 5993E

SML / TETC NO. : 91-212-3105

CLIENT PROJECT NO.: 5993E

CLIENT : VIAR COMPANY

REPORT DATE : Feb. 18, 1991

SUMMARIZED BY : S. Sayawatana

SAMPLE NO. : HD K 14-01

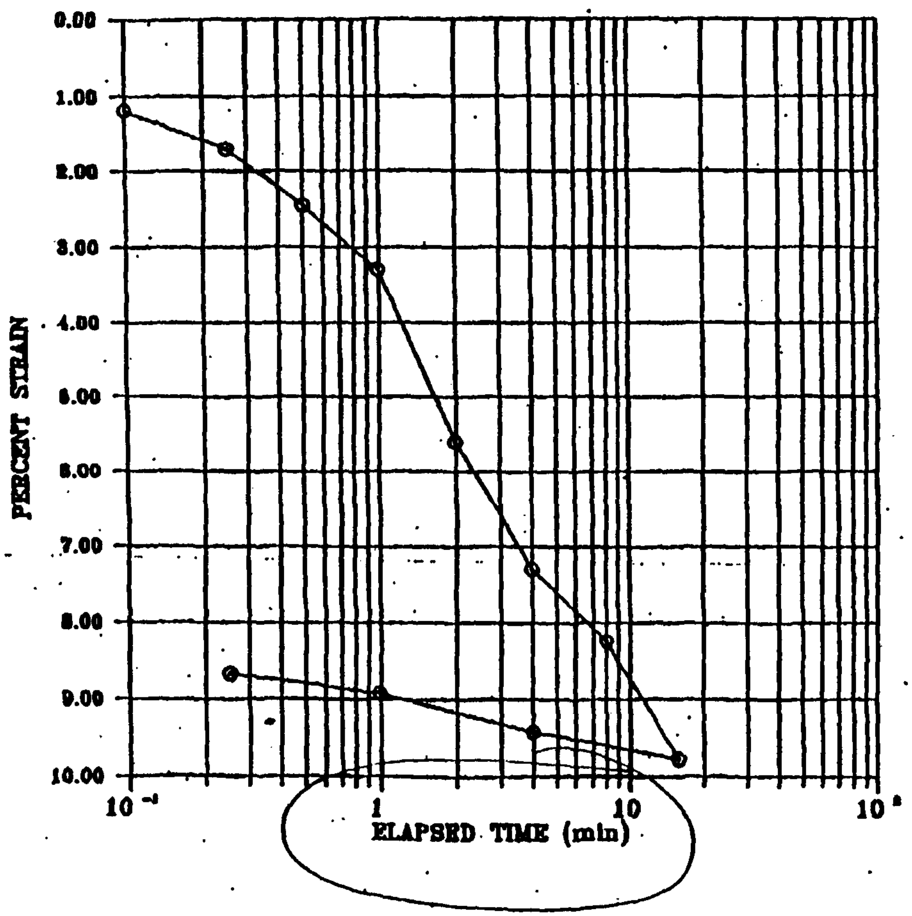
DEPTH : N/A ft.

INITIAL DRY DENSITY : 91.0 pcf.

INITIAL MOISTURE CONTENT : 34.0 pct.

INITIAL VOID RATIO : 0.816

SPECIFIC GRAVITY : 2.65 (assumed)



TECHNICAL MEMORANDUM NUMBER 6

DATE: January 23, 1991

TO: Vanessa Harris - Site Manager

CC: Marcia Kuehl - RI Lead
Roman Gau - Project Manager
Mike Crosser - TSQAM

FROM: Tom Puchalski

PRELIMINARY

SUBJECT: EPA Arcs Region V Contract No. 68-W8-0093
EPA Work Assignment No. 17-5L4J
Donohue Project No. 20026.024
Himco Dump

PRIVATE WELL SAMPLING AND BASEMENT AIR SCREENING

Introduction

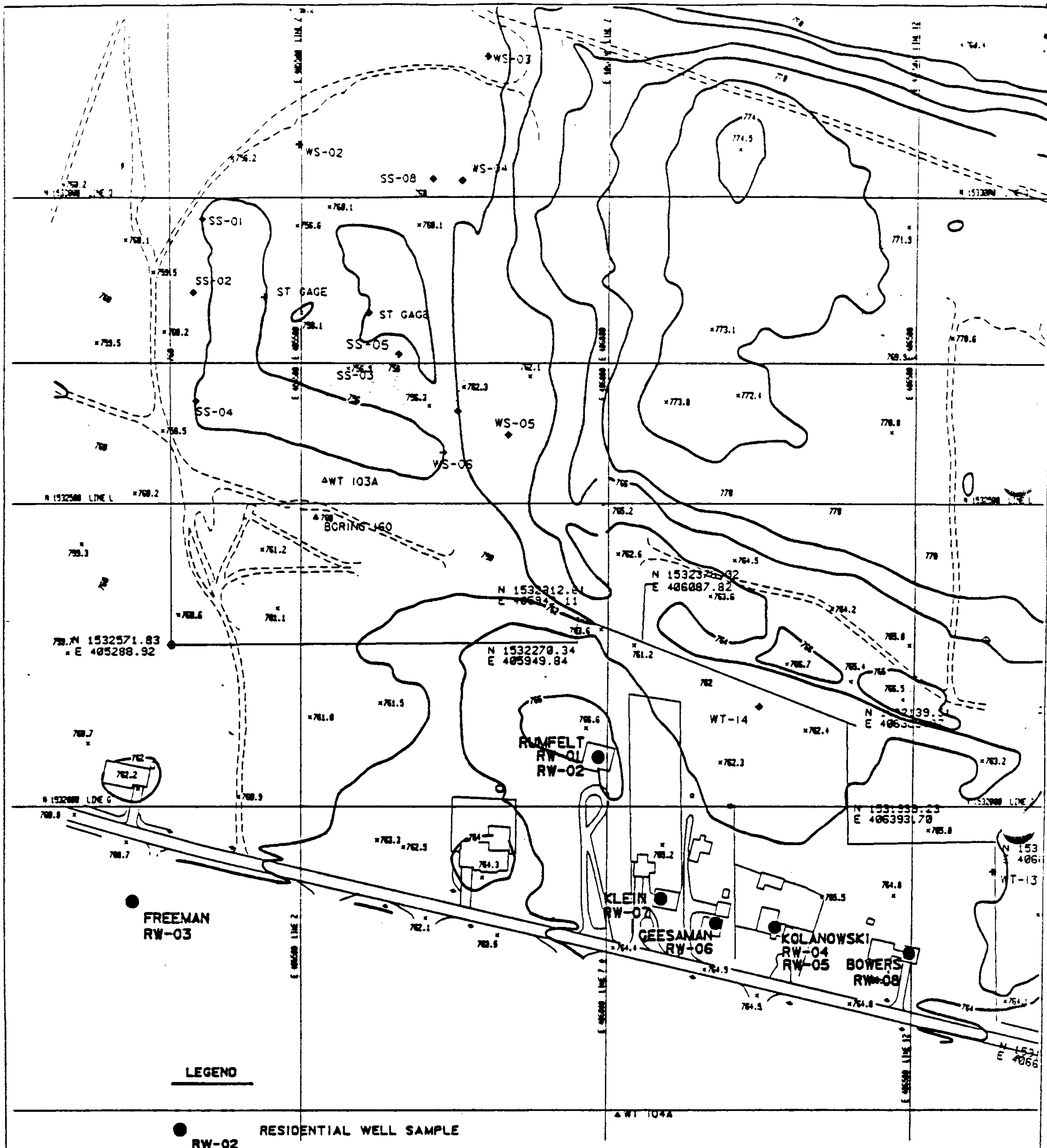
Groundwater samples were collected from five residential wells immediately south of the Himco Dump site along County Road 10, and one residential well immediately south of County Road 10 on October 22, 23, and 24, 1990. Four basements of these residences along County Road 10 were also screened for the presence of landfill gases.

Residential wells were sampled to investigate groundwater quality. Originally, all residences had shallow (approximately 22 feet deep) wells. Deeper wells (at 152 to 172 feet) were installed in 1974. Although the state found high levels of manganese in these wells in 1974 and were ordered replaced, some of the original shallow wells remain. Two wells were sampled at residences where an older shallow well was accessible in addition to their present deep wells. Shallow wells were sampled in addition to deep wells at the Rumfelt and Kolanowski residences.

Basement gas was screened to evaluate if landfill gas which may be generated at the site has migrated off-site and into these nearby resident's basements. This screening was qualitative to check for the presence of methane and hydrogen sulfide.

Methods

Groundwater sampling of residential wells and basement air screening was carried out as described in Sections 4.2.4 and 4.8 of the Final Field Sampling Plan, Himco Dump, Remedial Investigation/Feasibility Study, Elkhart, Indiana. The residents names and their addresses are: Noble and Selma Bowers, 28279 CR 10; Mark Freeman, 28552 CR 10; Dave and Joan Geesaman, 28331 CR 10; James and Christine Klein, 28343 CR 10; Helen Kolanowski, 28213 CR 10; and Herman and Patricia Rumfelt, 28369 CR 10 (Figure 1). Samples obtained from newer



MARCH 1991

FIGURE 1
RESIDENTIAL WELL LOCATIONS

HIMCO DUMP
SUPERFUND SITE
ELKHART, INDIANA

20026

Donohue ENGINEERS ARCHITECTS SCIENTISTS

deep wells were obtained directly from the tap at the kitchen sink or if available, at a tap in the basement ahead of the water softener. The tap was allowed to purge for five minutes before the sample was collected. Samples taken from shallow wells were purged by bailing. A 1-inch bailer was used in these 1 1/2-inch I.D. wells.

Samples for bromide analysis were field filtered using a millipore filtration unit and 0.45 micron filters. Measurements of field pH, conductivity, temperature, and dissolved oxygen were obtained at the field trailer immediately following sample collection. Preservatives, sample bottles, and holding times are summarized in Table 4-2 of the Final Field Sampling Plan.

Deviations

One of the six residences which were originally scheduled for well sampling and basement air screening was removed from the list when the owner of the home could not be located. A homeowner located south of the Himco Dump immediately south of County Road 10 (Freeman) solicited EPA to be added to the list of residential wells to be sampled. Sampling of the Freeman well brought the total residential well locations back up to the anticipated six. The Kolanowski residence did not have a basement and, consequently, was not screened for landfill gas.

Not all of the original six old shallow wells were intact and accessible. In practice, only two older shallow wells were accessible for sampling.

The shallow residential wells were not of large enough diameter (1 1/2-inch) to sample with a Keck pump as described in the field sampling plan. A 1-inch bailer was used as an alternative sampling method.

Five gallons were removed from each of the two residential wells. Readings of pH, conductivity, dissolved oxygen, and volume removed were not recorded during purging of the residential wells, but were recorded after 5 minutes of running the tap for deep wells, or upon removal of 5 gallons from shallow wells.

The 1-inch bailer was decontaminated between sampling locations by an alconox and tap water wash, a tap water rinse, an isopropanol rinse, and two deionized or distilled water rinses. Isopropanol rinsates were collected in a 5-gallon bucket and covered for eventual discharge into the on-site frac tank.

Summary of Results

Eight groundwater samples were collected from six locations. Six deep wells were sampled from taps and two shallow wells were sampled by bailing.

The Geesaman and Bower shallow wells were abandoned; the shallow Klein well was in a location which made it inaccessible to bailing, and the fourth shallow well was at a residence which was locked and not occupied.) Well Purging and Sample Collection field forms included in Appendix A give sampling times and measurements of pH, conductivity, temperature, and volumes of water removed as purging progressed.

Basement air was screened at the Rumfelt, Geesaman, Klein, and Bowers residences. A hydrogen sulfide and methane gas detector was used to screen the basement air. No detections of these compounds were registered during any of the basement air monitoring.

A/R/HIMCO/AB2

TECHNICAL MEMORANDUM NUMBER 7

DATE: January 24, 1991

TO: Vanessa Harris - Site Manager

CC: Marcia Kuehl - RI Lead
Roman Gau - Project Manager
Mike Crosser - TSQAM

FROM: Tom Puchalski

SUBJECT: EPA ARCS Region V Contract No. 68-W8-0093
EPA Work Assignment No. 17-5L4J
Donohue Project No. 20026.024
Himco Dump

LANDFILL CAP SOIL SAMPLING

Introduction

Twelve soil samples of the landfill cap at the Himco Dump site in Elkhart, Indiana, were sampled for chemical analysis on November 8, 9, 10, 11, and 12. Sampling methods described in the Final Field Sampling Plan, Himco Dump Remedial Investigation/Feasibility Study, Elkhart, Indiana were followed. Sampling was done by Eric Slusser and Tom Puchalski of Donohue & Associates, Inc. The purpose of sampling the landfill cap was to characterize the chemistry of the white powder matrix which makes up the majority of the cap material.

Methods

Section 4.0 of the Final Field Sampling Plan, Himco Dump Remedial Investigation/ Feasibility Study, Elkhart, Indiana, describes the method used for soil cap sampling and the technique used to define the sampling locations. The sampling locations were spread out to cover the entire landfill cap. Soil samples were located from a systematic grid marked by survey stakes. The actual soil sampling locations are provided in Figure 1. Completed soils data forms are in Appendix A.

The twelve soil samples were collected from depths as shallow as three to nine inches and as deep as eight to sixteen inches. The depth varied dependent upon the thickness of the overlying sand and topsoil cover. The cover material overlying the white silt, assumed to be calcium sulfate, was removed with a shovel prior to sampling at each location. A hand auger was used to dig out the white silt. The sample was placed in a composite bowl and immediately placed in two 4 oz. jars for volatile analysis. The remaining sample volume in the composite bowl was mixed using a stainless steel spoon. After a homogeneous mixture was obtained, the sample was divided into four quadrants. Small portions of each quadrant were used to fill each remaining sample jar.

Before sampling and between each sample location, all sampling equipment was decontaminated with: (1) a soap and tap water wash, (2) a tap water rinse, (3) an isopropanol rinse, and (4) two rinses with distilled or deionized water. Isopropanol rinses were retained in a covered 5-gallon pail for eventual discharge into the on-site frac tank.

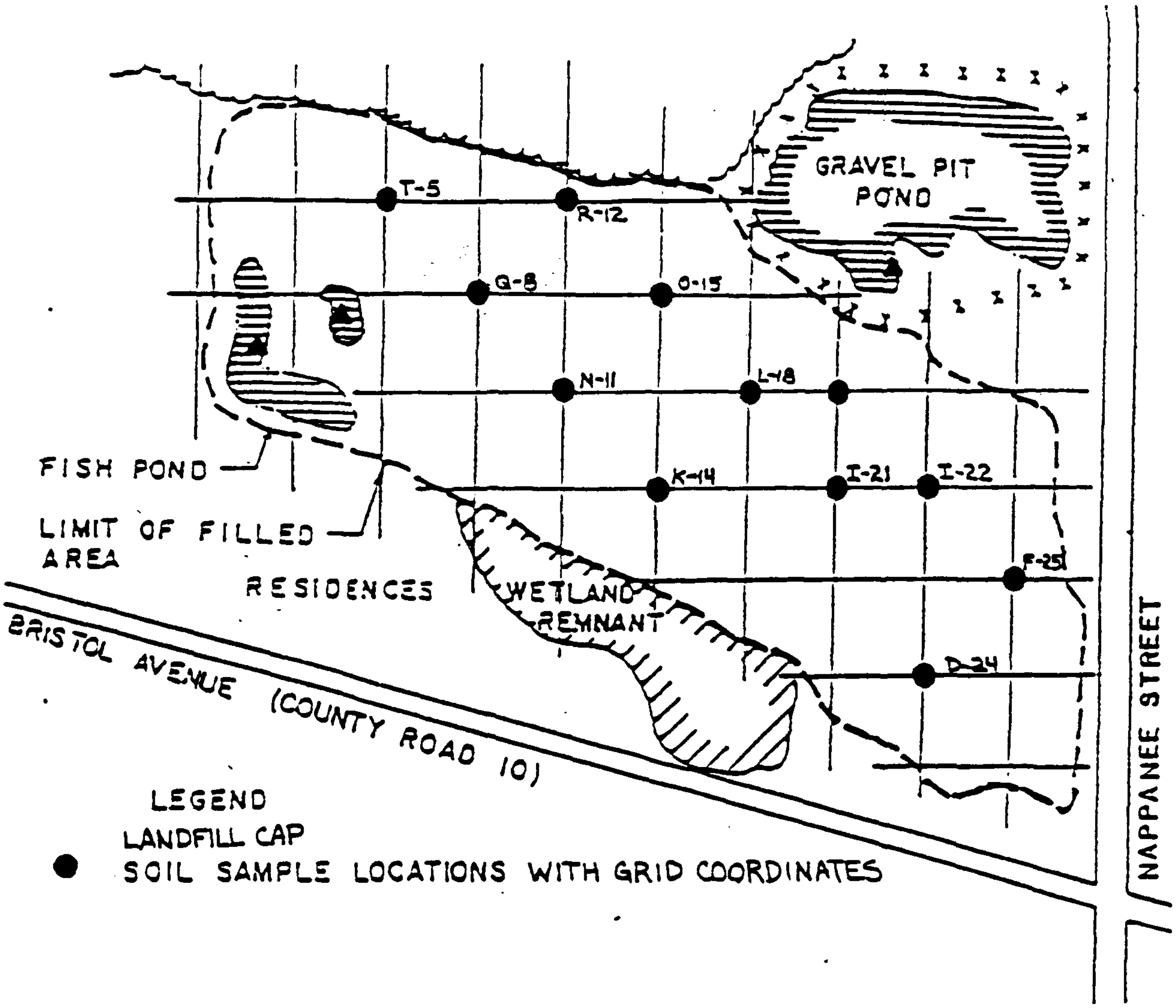
Deviations

Figure 4-1 of the sampling plan shows soil sampling locations based on a grid system which was not used in the field. The grid shown in Figure 4-1 is diagramatic and not meant to represent the final surveyed grid. It was designed to show approximate soil cap sampling locations. Actual grid points were selected in the field using the general pattern, as shown in Figure 4-1, so that the entire area of the landfill cap was sampled. The actual grid points are shown in Figure 1 of this memorandum. Photographs were not taken of each location on the landfill cap as the sampling areas were similar, and the photo would not aid in identifying the location.

Summary of Results

Soil samples of the cap soil material were taken at twelve locations spaced out across the area of the landfill cap. In general, the white silt thins from west to east. The appearance of the white silt is uniform with no discernible trends. Soils data forms are provided in Appendix A of this memorandum.

A/R/HIMCO/AB1



0 500 1000

SCALE: FEET
SCALE IS APPROXIMATE

SOURCE: US EPA, AUGUST, 1986

Donohue APPROXIMATE SITE SAMPLING LOCATIONS

N

20026
MAY, 1990

FIELD SAMPLING PLAN
HIMCO DUMP SITE
ELKHART, INDIANA

FIGURE 1

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SHEET 1 OF 1

Donohue | **Soils Data Form** | **Soil Sample Area** Capsoil Chem
Soil Subsample ~~T-5~~ GS-0

Engineers & Architects & Scientists **Site** Himco Dump **Project No.** 20026.02

DATE 11/8/90
TIME 1408
COLLECTOR TOM PUCHALSKI / ERIC SLUSSER

SAMPLE DEPTH 12-18" from surface

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: T-5 survey marker at northwest corner of landfill cap at edge of woods.

DESCRIPTION OF SUBSAMPLE: White silt (ML) non plas, low coh, damp.

ANY OTHER CHARACTERISTICS OF NOTE: 1 foot of fine gravel Brn silty sand fill on top of white cap material. Used a shovel to remove upper sand then hand augered from 12-18"

Donohue — **Soils Data Form**

Soil Sample Area Cap soil
Soil Subsample GS'02

Engineers & Architects & Scientists

Site Himco Dump **Project No.** 20026.02

DATE 11/8/90

TIME 1641

COLLECTOR TOM PUCHALSKI
ERIC SLUSSER

SAMPLE DEPTH 6-18"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: Q-8 survey stake ± 350 feet east of western edge of landfill cap

DESCRIPTION OF SUBSAMPLE: 6 inches of topsoil and brown silt, sand overlying sample. Sample is white silt (ML) non plas, low [illegible], damp.

ANY OTHER CHARACTERISTICS OF NOTE: Bottom of white silt cap at ≈ 18".

SHEET 1 OF 1

Donohue | **Soils Data Form** | **Soil Sample Area** Capsoil

Soil Subsample GS03

Engineers & Architects & Scientists **Site** Hinon Dump **Project No.** 20036.02

DATE 11/9/90

TIME 848

COLLECTOR TOM PUCHALSKI
ERIC SLUSSER

SAMPLE DEPTH 6-18"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: Cap soil at survey stake N-11 near middle of flat covered landfill, vegetation at ground surface consists of moss and grass.

DESCRIPTION OF SUBSAMPLE: Sample consists of white silt (ML) with a trace of fine brown sand in thin (≈ a few mm) stringers.

ANY OTHER CHARACTERISTICS OF NOTE:

SHEET 1 OF 1

Donohue **Soils Data Form** **Soil Sample Area** Capsoil

Soil Subsample GS04

Engineers & Architects & Scientists **Site** Himco Dump **Project No.** 20036.035

DATE 11/9/90

TIME 937

COLLECTOR TOM PUCHALSKI
ERIC SLUSSER

SAMPLE DEPTH 0-3" Silt, Sand Cover - Not sampled
3"-17" Sampled
white silt

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: Survey marker K-14 near southeast end of landfill cap about 300 feet north of wetland remnant

DESCRIPTION OF SUBSAMPLE: White silt (ML) with a trace of brown sand in thin fractures. Moist non plastic, low coh.

ANY OTHER CHARACTERISTICS OF NOTE: Sumac is dead in this area. Reached grey moist paper (waste) at 18". Methane gas was exiting the auger hole. We immediately covered the hole

SHEET 1 OF 1

Donohue | **Soils Data Form** | **Soil Sample Area** Landfill
Soil Subsample GS05

Engineers & Architects & Scientists **Site** Limco Dump **Project No.** 20076.02

DATE 11/10/90

TIME 841

COLLECTOR Eric Slusser
Tom Puchalski

SAMPLE DEPTH 8-16"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: Middle north area of landfill cap ≈ 100 feet ~~north~~ south of woods at survey stake R-12 11/11/90

DESCRIPTION OF SUBSAMPLE: White silt (ML) low coh, non plas, damp.

ANY OTHER CHARACTERISTICS OF NOTE: 0-8" brown fn grn silty sand fill. Refusal at 18" is light brown paste-like material. No odor

SHEET 1 OF 1

Donohue **Soils Data Form** **Soil Sample Area** Landfill Ca

Soil Subsample GS06

Engineers & Architects & Scientists **Site** Himco Dump **Project No.** 20026.025

DATE 11/10/90

TIME 905

COLLECTOR TOM PUCHALSKI
ERIC SLUSSER

SAMPLE DEPTH 6-14"
~~0~~

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: ≈ 200 feet south of brush at south end of quarry pond at survey stake A-15

DESCRIPTION OF SUBSAMPLE: White silt (ML), low coh, non plas, moist. 6" of cover fill consists of brown fine grained silty sand ~~cove~~ which was not sampled. Grey silty sand at 14" was also not sampled.

ANY OTHER CHARACTERISTICS OF NOTE:

SHEET 1 OF 1

Donohue | **Soils Data Form** | **Soil Sample Area** Landfill Cap
Soil Subsample GS07

Engineers & Architects & Scientists **Site** Himco Dump **Project No.** 20026.03

DATE 11/11/90

TIME 912

COLLECTOR ERIC SLUSSER
TOM PUCHALSKI

SAMPLE DEPTH 12-15"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: At survey location L-18 at area of grass and small trees and sumac at east edge of landfill cap ≈ 400 feet south of the west edge of the quarry pond.

DESCRIPTION OF SUBSAMPLE: Sample consists of white silt (ML) low coh, non plas, moist with brown fractures - rare.

ANY OTHER CHARACTERISTICS OF NOTE: A thin layer of white silt exists from 3-5" sandwiched between fine silty sand cover material

SHEET 1 OF 1

Donohue | **Soils Data Form** | **Soil Sample Area** [illegible]

Soil Subsample [illegible]

Engineers & Architects & Scientists **Site** [illegible] **Project No.** [illegible]

DATE 11/11/90

TIME 954

COLLECTOR TOM PUCHALSKI
ERIC SLUSSER

SAMPLE DEPTH 13"-15"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: Near west edge of access road at east edge of landfill cap at survey marker L-21. About 800 feet

DESCRIPTION OF SUBSAMPLE: White areas and light grey areas of silt (ML) with [illegible] - trace. Trace light yellow fractures
0-6" - Brown fine silty sand
6-13" Black cindery fill
13-15" White & gray silt — Sampled
15" Grey fine sand

ANY OTHER CHARACTERISTICS OF NOTE: Chemical odor

Donohue — Engineers & Architects & Scientists

Soils Data Form

Soil Sample Area Landfill Cap
Soil Subsample GS 19 [illegible]

Site Himco Dump Project No. 20026.0[illegible]

DATE 11/11/90
TIME 1127
COLLECTOR TOM PIKULSKI
ERIC SLUSSER

SAMPLE DEPTH 8-18"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: East edge of high flat landfill cap ~30 feet west of access road at survey marker I-21

DESCRIPTION OF SUBSAMPLE: White silt (ML) low plas. nonplas. moist with a trace of black fractures. 3" of brown fn grn SM cover - not sampled

ANY OTHER CHARACTERISTICS OF NOTE: Lichens at surface

Donohue **Soils Data Form**

Soil Sample Area Landfill Cap
Soil Subsample GS10

Engineers & Architects & Scientists **Site** Himco Dump **Project No.** 20026.033

DATE 11/12/90

TIME 853

COLLECTOR TOM PUCHALSKI
ERIC SLUSSER

SAMPLE DEPTH 3-9"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: Survey grid point I-22 at east edge of access road. Piles of asphalt debris nearby.

DESCRIPTION OF SUBSAMPLE: White silt (ML) interlayered with brown 10YR 5/3 fine grained silty sand (SM). Sample has an acrid H_2S odor.

ANY OTHER CHARACTERISTICS OF NOTE: Base of silt defined by lower fine grained brown sand.

SHEET 1 OF 1

Donohue | **Soils Data Form** | **Soil Sample Area** Landfill Cap
Soil Subsample GS11 & Dup

Engineers & Architects & Scientists **Site** Himco Dump **Project No.** 20026.023

DATE 11/12/90

TIME 947

COLLECTOR TOM PUCHALSKI
ERIC SLUSSER

SAMPLE DEPTH 0-4" - Cover soil - Not Sampled
4"-18" - Sampled

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: 60 feet west of Nappanee St extension at F-25

DESCRIPTION OF SUBSAMPLE: White silt with a trace of rootlets. Silt is moist, low coh. non plas.

ANY OTHER CHARACTERISTICS OF NOTE: Did not reach the base of the white silt

SHEET 1 OF 1

Donohue | **Soils Data Form** | **Soil Sample Area** Landfill Cap

Soil Subsample GS17

Engineers & Architects & Scientists | **Site** Himco Dump | **Project No.** 20026.073

DATE 11/12/90

TIME 1032

COLLECTOR ERIC SLUSSER
TOM PUCHALSKI

SAMPLE DEPTH 4-8"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: Survey stake D-24 east of access road ≈ 100 feet NE of job trailer

DESCRIPTION OF SUBSAMPLE: White silt (ML) with light brown fracture ~~fills~~ staining & rootlets.

ANY OTHER CHARACTERISTICS OF NOTE: Could not sample at D-23 as no white silt was present.

TECHNICAL MEMORANDUM NUMBER 8

DATE: April 3, 1991

TO: Vanessa Harris - Site Manager

CC: Roman Gau - Project Manager

Mike Crosser - TSQAM

PRELIMINARY

FROM: Tom Puchalski

SUBJECT: EPA ARCS Region V Contract No. 68-W8-0093

EPA Work Assignment No. 17-5L4J

Donohue Project No. 20026.024

Himco Dump RI/FS

WELL SAMPLING

Introduction

Ten groundwater monitoring wells installed during this investigation, and twenty-three previously installed wells were sampled at the Himco Dump site on November 14 through January 9, 1991, to investigate the vertical and horizontal extent and degree of contamination of the uppermost unconsolidated aquifer. Groundwater samples were collected by Eric Slusser, Steve Spiewak, Tracy Koach, and Anya Kirykowicz of Donohue & Associates, Inc. Groundwater samples were collected as described in Section 4.2.4 of the Final Field Sampling Plan, Himco Dump Remedial Investigation/Feasibility Study, Elkhart, Indiana. The well locations are shown in Figure 1. Completed purge and sample collection forms are in Appendix A. Table 1 contains the well bottom depths for all wells used in the sampling event.

Methods

All field meters were calibrated at the beginning of each day before sampling activities began. The sampling equipment was transported to each well location in plastic coolers.

After unlocking the protective casing, a photoionization detector was used to monitor the air near the casing top. A decontaminated water level measuring tape was then lowered into the well casings to obtain a water level and well bottom depth. This information was recorded on the purge and sample form. A well volume was calculated from this information so that at least five volumes could be removed during the purging process.

A YSI water quality meter was connected in-line with a Keck pump so that direct measurements of pH, conductivity, and temperature could be collected from the purge water. Purging continued until the readings have stabilized to pH $\pm$0.1 unit, conductivity $\pm$10 percent, and temperature to $\pm$0.5°C. This information was recorded on the purge and sample collection form. As soon as the purge pump was removed, a second reading of the water level was obtained.

An alternative purging method was used for 4-inch diameter wells due to the large volumes of purge water which needed to be removed before sampling. A stainless steel submersible pump was used which pumped up to 20 gallons per minute. This 220-volt electric pump received its power from a portable gasoline generator.

A 500-gallon polyethylene tank was strapped to the back of a four-wheel drive pickup truck so that the purge water could be collected from each well and transported to the on-site 21,000-gallon frac tank. Measurements of pH, conductivity, and temperature were recorded periodically during the purging process with a combination pH, conductivity, temperature meter. The Keck pump was used to sample these wells following purging with the submersible pump.

Wells F-1 and F-3 were purged by bailing with a 1-inch diameter bailer. Readings of pH, conductivity, and temperature were collected periodically as purging progressed.

The time between the completion of purging and the collection of the sample did not exceed 24 hours for any well. Table 4-2 of the Final Field Sampling Plan summarizes the sample container and preservative requirements. When a preservative was added to a sample, pH paper was used to ensure that adequate preservative was added.

Samples obtained for dissolved metals or bromide analysis were collected in a one liter polyethylene container for filtration at the field trailer. Samples were filtered with 0.45 micron paper using a millipore filtration unit in combination with nitrogen supplied by a pressurized tank.

All samples were stored in coolers with ice until custody was relinquished to the sample custodian at the field trailer.

Outer parts of the Keck pump and the one-inch bailer, which came into contact with groundwater and were used for sample collection, were cleaned between wells with an Alconox and tap water wash, a tap water rinse, an isopropanol rinse, and two deionized water rinses. The inner parts of the Keck pump and the submersible purge pump were cleaned by pumping distilled water through the system, or in the case of the purge pump, by rinsing the inside and outside several times with distilled water.

Deviations

Wells F-1 and F-3 were purged and sampled with a bailer instead of a Keck pump as described in the sampling plan. A Keck pump was too large to fit in these wells. Using a bailer did not effect the sample integrity.

A 3-inch submersible pump was used to purge the 4-inch diameter wells because a more rapid purging method than a Keck pump was needed to remove the large volume of groundwater from these wells. The purging was followed with sampling accomplished with a Keck pump.

Summary of Results

Twenty-three wells installed in 1977 and 1979 by the U.S.G.S. and ten wells installed by Donohue for this investigation were sampled for groundwater. Large volumes of purge water were required to be removed to purge the required five-well volumes because of the 4-inch diameter and extreme depth (up to 495 feet) of some of the U.S.G.S. wells.

TP/ke

A/P/HIMCO/AG7

WELL DESIGNATION	DEPTH TO SCREEN BOTTOM (in ft.)
B-1	495
B-2	12
B-3	129
B-4	173
CP-1	20
E-2	17
E-3	174
F-1	32
F-2	153
F-3	15
G-1	50
G-3	169
I-1	172
I-2	15
I-3	35
J-1	40
J-2	18
J-3	152
M-1	24
M-2	103
N-1	30
O-1	20
Q-1	20

WT-101A*	18.75
WT-102A*	18.50
WT-103A*	18.50
WT-104A*	18.80
WT-105A*	18.50
WT-106A*	21.25
P-101B*	100.50
P-101C*	167.50
P-102B*	67.90
P-102C*	162.00

* Wells installed by Donohue during this investigation. All others were installed by the U.S.G.S. in 1977 and 1979.

A/P/HIMCO/AG7

APPENDIX A

WELL PURGE AND SAMPLE COLLECTION FORMS

Donohue
Engineers & Architects

Well Purging and Sample Collection

.N-1

Project No. [illegible]   Site Hinco Dump

Method of Purging   Pumped ✓   Bailed

Equipment   Airlift   N2 Lift   In. Bailer   Length   Ft. Material

Pump KECK   Manufacturer   Diameter   Description of site (weather, temp., soil, conditions)

Well No. / Time	Depth to Water	Depth to Bottom	Volume Calculated (gal.)	Volume Removed (gal.)	Depth After	pH	Cond.	Temp	Turbidity Y/N	Comments
1555	8.95	29.29	3.32							
1605						7.35	.143	11.8	Y	SLIGHT [illegible]
1610				3.5		7.63	.296	12.5	Y	SLIGHT (LT. [illegible])
				7.0		7.63	.300	12.6	Y	[illegible]
1615				10.5		7.62	.302	12.7	N	
1618				14.0		7.61	.305	12.7	N	
1623				17.5		7.60	.309	12.7	N	
1630	[illegible]									
1645	FINISH									DISSOLVED OXYGEN
										= 4.25

Notes: 2" well .163 x 20.34 = 3.32 gal = 1 well vol   WC = 29.29 - 8.95 = 20.34

[illegible]

Signature [illegible]   Date 11-29-90

Donohue
Engineers & Architects

Well Purging and Sample Collection

O-1

Project No. [illegible] Site [illegible] Dump

Method of Purging Pumped ✓ Bailed

Equipment Airlift N2 Lift In. Bailer Length Ft. Material

Pump [illegible] Manufacturer Diameter Description of site (weather, temp., soil, conditions)

12/3/90

Well No. / Time	Depth to Water	Depth to Bottom	Volume Calculated (gal.)	Volume Removed (gal.)	Depth After	pH	Cond. mS/cm	Temp °C	Turbidity Y/N	Comments
C-1 1530	9.16	29.5	3.32							
C-1 1535				0		7.8	0.523	12.0	Slighty	
C-1 1538				3.5		7.89	0.529	12.5	CLEAR	
C-1 1540				7.0		7.90	0.524	12.6	CLEAR	
C-1 1542				10.5		8.36	0.529	12.6	CLEAR	
C-1 1544				14.0		14.75	0.515	12.6	CLEAR	PH went up to 14.75
C-1 1546				17.5		9.17	0.514	12.6	CLEAR	
C-1 1548				21.0		8.36	0.512	12.6	CLEAR	
C-1 1550				24.5		8.11	0.511	12.6	CLEAR	
C-1 1552				28.0		8.00	0.510	12.6	CLEAR	
C-1 1554				31.5		7.93	0.507	12.6	CLEAR	
C-1 1556				35.0		7.90	0.506	12.6	CLEAR	
				~~38.5~~	AK 12/3/90					
C-1 1600					[illegible]					Sampling
C-1 1620					~~TQ~~ 9.15					
										DISSOLVED OXYGEN = 2.5

Notes: O-1: 29.5 - 9.16 = 20.34; 20.34 x 0.163 = 3.32; 3.32 x 5 = 16.6

Signature [illegible] Date 12-3-90

Donohue

Engineers & Architects

Well Purging and Sample Collection

R-1

Project No. [illegible] Site [illegible]

Method of Purging Pumped ✓ Bailed

Equipment Airlift N2 Lift In. Bailer Length Ft. Material

Pump KECK Manufacturer Diameter Description of site INDUSTRIAL STREET VACANT TO HYDRANT GRID
(weather, temp., soil, conditions) PT. SUNNY, WINDY LO 40'S

Well No. / Time	Depth to Water	Depth to Bottom	Volume Calculated (gal.)	Volume Removed (gal.)	Depth After	pH	Cond.	Temp	Turbidity Y/N	Comments
R-1				0		7.69	.186	10.5		1320
13[illegible]	4.97	23.69	3.05	3.1		7.61	.454	12.2	Y VERY	GREENISH TINT
1335				6.2		7.61	.577	12.9	Y SLIGHT	LT GREENISH TINT
1400				9.3		7.57	.566	13.0	Y SLIGHT	"
1413				12.4		7.51	.561	13.0	Y SLIGHT	VERY LT GRN TINT
14[illegible]				15.5		7.49	.553	12.9	Y SLIGHT	"
1410	SAMPLING									
1420	FINISH				4.97					
										D.O. = 3.3

Notes 2" well 0.163 × 18.72 = 3.05 = 1 well volume WC = 23.69 − 4.97 = 18.72 ft

Donohue
Engineers & Architects

Well Purging and Sample Collection

WT 101A

Project No. 20086.133 Site Hilco Dump

Method of Purging Pumped ✓ Bailed

Equipment ______ Airlift ______ N2 Lift ______ In. Bailer ______ Length ______ Ft. Material ______

Pump KECK Manufacturer ______ Diameter ______ Description of site GRASSY MID 30's CLDY, WINDY
(weather, temp., soil, conditions)

Well No. / Time	Depth to Water	Depth to Bottom	Volume Calculated (gal.)	Volume Removed (gal.)	Depth After	pH	Cond.	Temp	Turbidity Y/N	Comments
WT 101A										
15:53	11.36	18.55	1.21	1		7.45	.989	11.1	slightly turbid	16:04 [illegible]
16:04				1.5		7.45	.989	11.7	slightly turbid	Color — yellow in green
16:06				3.0		7.44	.984	12.1	v. slightly turbid	
16:07				4.5		7.41	.977	12.2	v. slightly turbid	
16:08				6.0		7.38	.971	12.3	v. slightly turbid	
16:10				7.5		7.35	.965	12.3	v. slightly turbid	
1622	sampling									
1655	finish at WT 101B									
										DISSOLVED OXYGEN
										5.35

Notes: 2" old calc. 0.163 × 7.19 = 1.17 gals = 1 well vol. 18.70 − 11.26 = 7.44 ft

7.44 × 0.163 = 1.21 gals = 1 well vol.

[illegible] YSI 3000 meter

[illegible]

Donohue
Engineers & Architects

Well Purging and Sample Collection

WT 10A

Project No. [illegible] Site [illegible] DUMP

Method of Purging Pumped ✓ Bailed

Equipment ✓ Airlift N2 Lift In. Bailer Length Ft. Material

Pump [illegible] Manufacturer Diameter Description of site (weather, temp., soil, conditions) [illegible] WINDY [illegible]

Well No. / Time	Depth to Water	Depth to Bottom	Volume Calculated (gal.)	Volume Removed (gal.)	Depth After	pH	Cond.	Temp	Turbidity Y/N	Comments
WT 10A						~~7.43~~	~~1.645~~	10.7		
1420	[illegible]	18.16	1.25	1		7.93	1.645	10.7	Y slightly turbid	(1430)
1422				1.5		7.96	1.654	11.7	Y slightly turbid	
1424				3.0		7.98	1.654	12.1	N	
1425				4.5		7.98	1.658	12.3	N	
1426				6.0		7.96	1.656	12.3	N	
1427				7.5		7.95	1.653	12.3	N	
1437	SAMPLING									
1455	[illegible]									DISSOLVED OXYGEN 6.41

Notes: 2" old calc. 0.163 x 7.11 = 1.16 gal = 1 well vol. 15.16 - 10.3 = 7.86 ft

0.163 x 7.86 = 1.25 gals = 1 well vol.

CONDUCTIVITY ON 2 SCALE READING ON YSI 33 METER

Signature [illegible] Date [illegible]

WT 103A

Donohue
Engineers & Architects

Well Purging and Sample Collection

Project No. 10026.03 Site Vinco Dump

Method of Purging Pumped ✓ Bailed

Equipment ____ Airlift ____ N2 Lift ____ In. Bailer ____ Length ____ Ft. Material ____

Pump KCK Manufacturer ____ Diameter ____ Description of site (weather, temp., soil, conditions) ____

Well No. / Time	Depth to Water	Depth to Bottom	Volume Calculated (gal.)	Volume Removed (gal.)	Depth After	pH	Cond.	Temp	Turbidity Y/N	Comments
WT 103A										
1135	5.29	18.48	2.15	1		7.92	.495	12.1	slightly	(11 49 [illegible])
11 51				2.5		8.13	.533	14.4	N	
11 53				5.0		8.18	.539	15.4	N	
11 54				7.5		8.08	.537	15.5		
11 56				10.0		8.05	.537	15.5		
11 58				12.5		8.03	.536	15.6		
1202	SAMPLING									
1220					5.29					DISSOLVED OXYGEN
										2.21

Notes

old calc. WL 18.48 - 5.29

2" 0.163 x 12.34 = 2.01 gal = 1 well vol.

new 0.163 x 13.19 = 2.15 gal = 1 well vol

CONDUCTIVITY [illegible] SCALE READING ON YSI 33 [illegible]

Signature [illegible] Date 11-25-[illegible]

Donohue
Engineers & Architects

Well Purging and Sample Collection

WT 104A

Project No. 20026 013 Site Himco Dump

Method of Purging Pumped ✓ Bailed

Equipment Airlift N2 Lift In. Bailer Length Ft. Material

Pump Keck Manufacturer Diameter Description of site Grass, Breezy, mid 40's
(weather, temp., soil, conditions)

Well No. / Time	Depth to Water	Depth to Bottom	Volume Calculated (gal.)	(Total) Volume Removed (gal.)	Depth After	pH	Cond.	Temp	Turbidity Y/N	Comments
WT 104A										
0920	11.75	18.90	1.2 gal	0		7.77	0.083	10.1	slightly	
0921				2		7.97	0.093	10.8		
0923				3.5		8.25	0.097	11.0		
0924				5		8.34	0.098	11.1		
0926				6.5		8.44	0.100	11.2		
				8		8.49	0.101	11.3		
				9.5		8.53	0.102	11.3		
				11.0		8.55	0.102	11.3	clear	
0932				12.5		8.56	0.102	11.3		
0934				14		8.57	0.103	11.3		
0935	Begin Sampling									D.O. = 10.0 mg/l
	TAKE Field Duplicate									
1020	FINISH				11.75					

Notes:
old cal.
0.163 x 6.32 = 1.03 gal = 1 well vol.
new cal
0.163 x 7.15 = 1.17 gal = 1 well vol.

Conductivity meter on 2 x 10 reading mS/cm on YSI 3500 meter

WT-10S/R

Donohue
Engineers & Architects

Well Purging and Sample Collection

Project No. 50036.023 Site HIMCO DUMP

Method of Purging Pumped ✓ Bailed

Equipment ____ Airlift ____ N2 Lift ____ In. Bailer ____ Length ____ Ft. Material ____

Pump KECK Manufacturer ____ Diameter ____ Description of site [illegible]
(weather, temp., soil, conditions)

Well No. / Time	Depth to Water	Depth to Bottom	Volume Calculated (gal.)	Volume Removed (gal.)	Depth After	pH	Cond.	Temp	Turbidity Y/N	Comments
WT 10S/R										
910	9.72	18.52	1.43	1		8.07	.306	11.2	Y	[illegible] SLIGHT
				1.5		8.14	.304	11.7	Y	"
				3.0		8.16	.299	12.1	Y	VERY SLIGHT
				4.5		8.15	.297	12.2	N	
927				6.0		8.14	.297	12.2	N	
				7.5		8.13	.296	12.2	N	
9??	STOP SAMPLE [illegible]									
925	FINISH									
										D.O. = 5.25

Notes 2" well

old calc.
0.163 x 8.32 = 1.36 gal 1 well vol
0.163 x 8.80 = 1.43 gal 1 well vol

18.52 - 9.72 =
WC = 8.80

[illegible]

Signature [illegible] Date 11-29-90

Donohue
Engineers & Architects

Well Purging and Sample Collection

WT 106A

Project No. 20026023 Site Himco Dump

Method of Purging Pumped x Bailed

Equipment Keck Airlift N2 Lift In. Bailer Length Ft. Material

Pump Manufacturer Johnson Diameter Description of site [illegible] 50s-60s, scattered
(weather, temp., soil, conditions)

14°C

Well No. / Time	Depth to Water	Depth to Bottom	Volume Calculated (gal.)	Volume Removed (gal.)	Depth After	pH	Cond.	Temp	Turbidity Y/N	Comments
WT 106A 10:34	9.46	18.47	1.5	1.0		7.15	684	63	N	DO 2.2
10:39				3.0		7.18	710	60.8	N	DO 2.1
10:43				4.5		7.13	711	59.2	N	DO =2.3
10:47				6.0		7.08	728	59.0	N	DO =2.2
10:51				7.5	9.46	7.08	733	59.0	N	DO =2.2
	Sampled		10:55							

Notes 2" well πr^2 (7.48) = 0.163   0.163 x 9.09 = 1.4 gal (old calc.)
new 0.163 x 9.01 ft = 1.46 = 1.5 gallons 1 well vol.

Signature [illegible] Date 11-27-9?

P-101 B

Donohue
Engineers & Architects

Well Purging and Sample Collection

Project No. 20026.023 Site Himco Dump

Method of Purging Pumped ✓ Bailed

Equipment Airlift N2 Lift In. Bailer Length Ft. Material

Pump Manufacturer Keck Diameter 1.75" Description of site (weather, temp., soil, conditions) Cold Snowing, wind NW 5-10 mph.

Well No. / Time	Depth to Water	Depth to Bottom	Volume Calculated (gal.)	Volume Removed (gal.)	Depth After	pH	Cond.	Temp	Turbidity Y/N	Comments
P-101B 8:52	9.30	100.70	14.90	15		9.70	.736	11.8	Y	Slightly turbid lt tan
9:02				30		9.28	.887	11.9	Y	Slightly turbid lt tan
9:13				45		8.90	.846	11.8	Y	slightly turbid lt tan
9:23				60		8.63	.825	11.8	Y	Slightly turbid [illegible]
9:34				75		8.52	.801	[illegible]	Y	V slightly turbid milky
9:[illegible]				90		8.44	.776	11.8	Y	V slightly turbid milky
10:[illegible]				105		8.48	.759	11.5	Y	V slightly turbid milky
	Water Sampled			12:09						

Notes 2" well WC = 100.70 - 9.30 = 91.50

91.40 x 0.163 = 14.90

Conductivity Readings on 2 scale in m℧/cm

Signature [illegible] Date 1/9/91

P-101C

Donohue
Engineers & Architects

Well Purging and Sample Collection

Project No. 20026 023 Site Himco Dump

Method of Purging Pumped ✓ Bailed

Equipment ____ Airlift ____ N2 Lift ____ In. Bailer ____ Length ____ Ft. Material ____

Pump ____ Manufacturer Keck Diameter 1.75" Description of site Cold, cloudy, scattered (weather, temp., soil, conditions)

Snow, low 30s

Well No. / Time	Depth to Water	Depth to Bottom	Volume Calculated (gal.)	Volume Removed (gal.)	Depth After	pH	Cond.	Temp	Turbidity Y/N	Comments
P-101C 14:57	9.40	163.0*	25.04	25		8.07	.436	12.0	Y	Slightly turbid Lt Gr.
15:14				50		7.98	.434	11.9	Y	[illegible]
15:32				75		7.94	.424	11.8	Y	Lt Gray-Brown turbid-slightly
15:49				100		7.92	.422	11.8	Y	✓ Slightly turbid Lt Gray-Brown
16:07				126		7.91	.422	11.7		
	Water Sample 16:11									

Notes 2" well = 153.6 x 0.163 = 25.04   wc = 163.0 - 9.40 = 153.6

* very muddy bottom, hard to tell may have ~2 - 3' of Sediment

Conductivity readings on 2 scale in mv/cm

Signature [illegible] Date 1/9/91

WT-106 A

Donohue
Engineers & Architects

Well Purging and Sample Collection

Project No. 20026 023 Site Himes Dump

Method of Purging Pumped ✓ Bailed

Equipment Airlift N2 Lift In. Bailer Length Ft. Material

Pump X Manufacturer Keck Diameter 1.75 Description of site Cold cloudy mid 20s
(weather, temp., soil, conditions)

Well No. / Time	Depth to Water	Depth to Bottom	Volume Calculated (gal.)	Volume Removed (gal.)	Depth After	pH	Cond.	Temp	Turbidity Y/N	Comments
16:01	7.10	18.60	1.87	2		7.44	.353	9.3	Y	
16:02				4		7.23	.566	9.9	N	
16:04				6		7.21	.604	10.1	N	
16:06				8		7.21	.614	10.1	N	
16:08				10	7.10	7.21	.624	10.2	N	
	Water Sampled at				16:11					

Notes 2" well 11.50 X 0.163 = 1.87 = 1 well vol Wd 18.60 - 7.10 = 11.50

Conductivity reading on 2 scale in m℧/cm

Signature [illegible] Date 1-8-91

WT-105A

Donohue
Engineers & Architects

Well Purging and Sample Collection

Project No. 20026 023 Site Hines Dump

Method of Purging Pumped ✓ Bailed

Equipment ____ Airlift ____ N2 Lift ____ In. Bailer ____ Length ____ Ft. Material ____

Pump 2" Manufacturer Keck Diameter 1.75 Description of site cold cloudy mid 20's
(weather, temp., soil, conditions)

Well No. / Time	Depth to Water	Depth to Bottom	Volume Calculated (gal.)	Volume Removed (gal.)	Depth After	pH	Cond.	Temp	Turbidity Y/N	Comments
WT 105A 14:48	8.10	18.70	1.73	2		8.05	.175	10.4	Y	Lt Gr
14:50				4		7.89	.196	10.4	N	
14:51				6		7.89	.197	10.5	N	
14:53				8		7.89	.200	10.5	N	
14:54				10		7.89	.202	10.5	N	
					~~E~~ Ft.					

Notes 2" well 10.60 x 0.163 = 1.73 = 1 well vol WC = 18.70 - 8.10 = 10.60

Conductivity on 2 scale in mS/cm

Donohue
Engineers & Architects

Well Purging and Sample Collection

P-102 C

Project No. 20026023 Site Hino Dump

Method of Purging Pumped ✓ Bailed

Equipment Airlift N2 Lift In. Bailer Length Ft. Material

Pump ✓ Manufacturer Keck Diameter 1.75 Description of site (weather, temp., soil, conditions) cool cloudy

-8-91

Well No. / Time	Depth to Water	Depth to Bottom	Volume Calculated (gal.)	Volume Removed (gal.)	Depth After	pH	Cond.	Temp	Turbidity Y/N	Comments
9:54	7.6	157.6	24.35	25		7.87	.243	11.2	Y	[illegible]
10:23				50		7.80	.301	11.2	Y	[illegible]
10:40				75		7.77	.301	11.2	N	
10:57				100		7.76	.300	11.2	N	
11:44				125		7.77	.300	11.3	N	
					11.35					
	Water	Sample		11:50						

Notes 2" well 149.4 x 0.163 = 24.35 = 1 vol. WC 157 - 7.6 = 149.4

Drawdown - twice lowered pump to accommodate formation flow (not as high a recharge) pump down ~35 below TOC

Conductivity Readings on the 2 scale in mV/cm

8 10

11/8/91

P-102B

Donohue
Engineers & Architects

Well Purging and Sample Collection

Project No. 25526.023 Site Himco Dump

Method of Purging Pumped ✓ Bailed

Equipment Airlift N2 Lift In. Bailer Length Ft. Material

Pump ✓ Manufacturer Keck Diameter 1.75 Description of site Sunny cold mid 20's
(weather, temp., soil, conditions)

Well No. / Time	Depth to Water	Depth to Bottom	Volume Calculated (gal.)	Volume Removed (gal.)	Depth After	pH	Cond.	Temp	Turbidity Y/N	Comments
P-102B / 14:05	9.11	67.35	9.49	10		7.46	.454	11.5	N	much silt st 2:42 14:50
14:51				20		7.45	.456	11.4	N	
15:01				30		7.45	.455	11.4	N	
15:14				40		7.45	.455	11.3	N	
15:38				50		7.47	.454	11.3	N	
					9.25					
	Water	Sampled		at	15:42					

Notes 2" well WC = 67.35 − 9.11 = 58.24

58.24 × 0.163 = 9.49 gallons = 1 well vol

Conductivity on 2 scale of YSI mS/cm

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Well Purging and Sample Collection

MW-10A

Project No. 20021023 Site Hines Dump

Method of Purging Pumped ✓ Bailed

Equipment ____ Airlift ____ N2 Lift ____ In. Bailer ____ Length ____ Ft. Material ____

Pump ✓ Manufacturer Keck Diameter 1.75 Description of site Cold sun 12-20° wind (weather, temp., soil, conditions)

South <5 mph, gust up to 12 mph

-7-91

Well No. / Time	Depth to Water	Depth to Bottom	Volume Calculated (gal.)	Volume Removed (gal.)	Depth After	pH	Cond.	Temp	Turbidity Y/N	Comments
MW-10A 13:18	9.45	18.16	1.42	1.5		7.30	.800	13	Y	OVA = 0
13:20				3.0		7.36	.560	11.2	Y	
13:21				4.5		7.28	.562	11.2	N	
13:22				6.0		7.28	.569	11.1	N	
13:23				7.5		7.28	.568	11.1	N	
					9.45					
	Water	Sample		13.24						

WC = 18.16 - 9.45 = 8.71

Notes 0.163 x 8.71 = 1.42 = 1 well vol

Conductivity Reading on 2 scale in m℧/cm

TECHNICAL MEMORANDUM NUMBER 9

DATE: January 28, 1991

TO: Vanessa Harris - Site Manager

CC: Marcia Kuehl - RI Lead
Roman Gau - Project Manager
Mike Crosser - TSQAM

PRELIMINARY

FROM: Tom Puchalski

SUBJECT: EPA ARCS Region V Contract No. 68-W8-0093
EPA Work Assignment No. 17-5L4J
Donohue Project No. 20026.024
Himco Dump RI/FS

SURFACE WATER/SEDIMENT SAMPLING

Introduction

Surface water and sediment samples were taken at four locations at each of the three ponds at the Himco Dump Site in Elkhart, Indiana, to investigate the degree and extent of surface water and sediment contamination. Sampling was done by Eric Slusser and Tom Puchalski of Donohue & Associates, Inc., on October 17, 18, 19, and 20, 1991. This memorandum describes the sampling methods used in the field as compared to the methods described in the Final Field Sampling Plan.

Methods

Three surface water bodies are present at the Himco Dump Site. The two smaller ponds are located at the southwestern portion of the site. The larger of these two ponds is "L"-shaped with the longer channel oriented north-south and the shorter channel oriented east-west. Both channels of the "L"-shaped pond are approximately 100 feet wide and 400 feet long. The smaller pond is directly northeast of the "L"-shaped pond and is approximately 100 by 170 feet. The shorelines and bottoms of these two ponds are generally gravel and sand. Their depths are unknown, but because they were excavated with a backhoe, they are assumed to be less than 15 feet deep.

The gravel pit pond is the largest surface water body on-site. It is located in the northeast corner of the study area. It is approximately 850 feet wide in the east-west direction and 400 to 550 feet wide in the north-south direction. The depth of the gravel pit pond is unknown. The shoreline and bottom is generally gravel and sand.

The four locations at each of the three ponds were selected so that the north, south, east, and west shorelines were sampled (Figure 1). A description of the sampling location was written on the surface water and sediment field data form (Appendix A). A photograph was taken of each sample location.

The surface water samples were collected before the sediment samples and on different days at all locations. Surface water was collected by lowering the capped sample bottle below the surface and opening it under water to allow the sample to trickle in. The bottle was then capped under water and brought back up out of the water. The water sample was put in a cooler with ice to be transported to the field trailer. Readings of pH, conductivity, temperature, and dissolved oxygen were taken in the back of a pickup truck at the edge of the pond immediately after carrying them from each location (Table 1).

Sediment samples were collected at the same locations as were surface water samples at approximately 2 to 3 feet offshore at water depths which ranged from 0 to 2 feet. A shovel was used to collect the sample from approximately 0 to 4 inches. Sediment samples were placed in a stainless steel bowl, and the excess water was poured off. Grab samples for volatile analysis were immediately placed in two 4-oz. jars with no headspace. The remainder of the sample was mixed using a stainless steel spoon. The resultant homogeneous mixture was spread evenly in the bowl. The sediment was divided into four quadrants. Small portions were taken from each quadrant for each jar until the remaining jars were filled. A visual description, including texture and color, was written on the field data form.

The shovel, sample composite bowl, and mixing spoon were decontaminated between sample locations by:

1. Alconox and tap water water wash.
2. A tap water rinse.
3. An isopropanol rinse.
4. Two deionized or distilled water rinses.

Isopropanol rinsates were collected in a 5-gallon bucket and covered until eventual discharge into the on-site frac tank.

Deviations

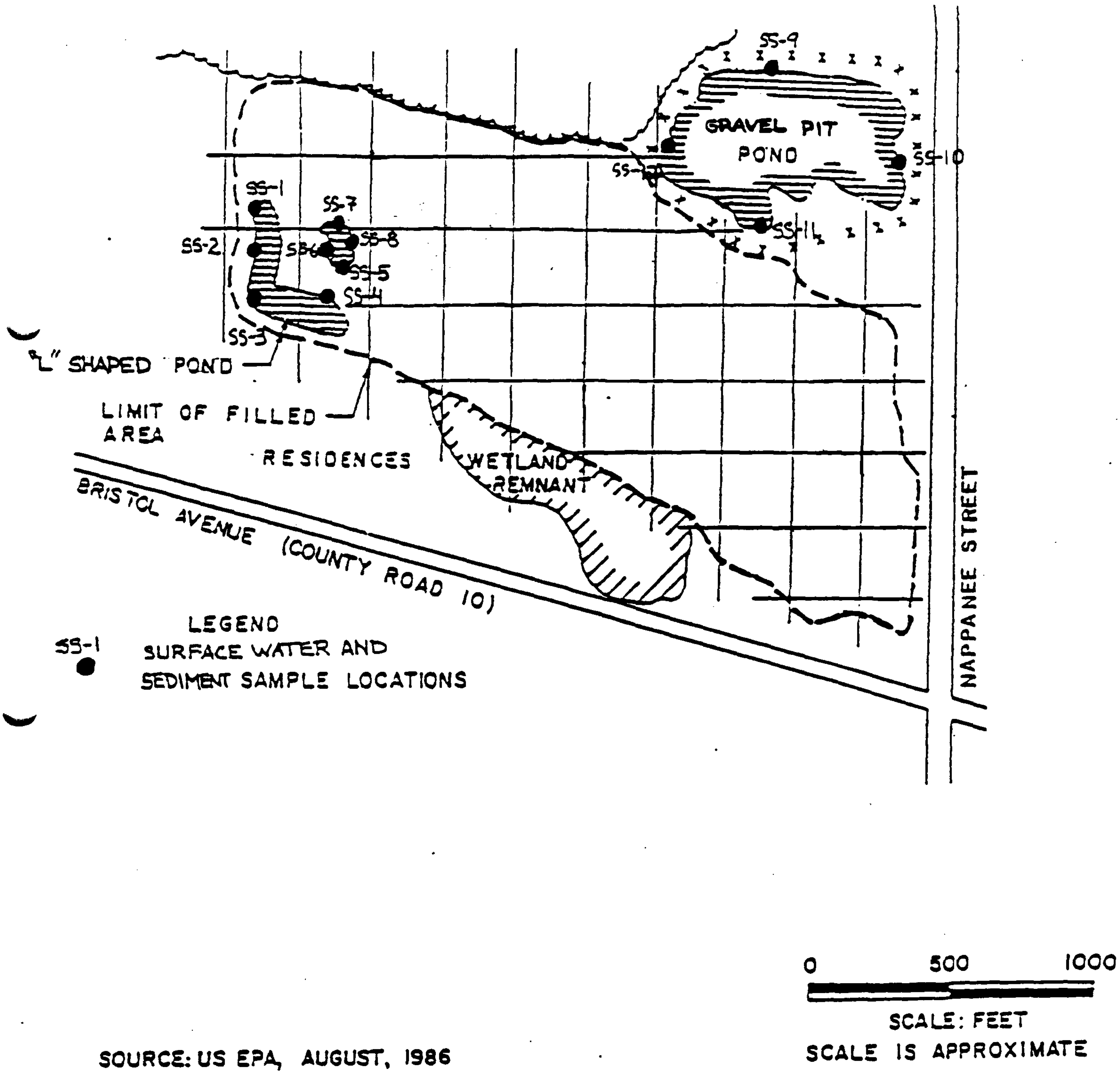
A shovel was used instead of a bucket to collect the sediment sample because the sediment was consolidated by plant roots in some locations to the degree that a bucket could not scrape up the required sample volume.

Summary of Results

Twelve surface water and twelve sediment samples were collected. No visual evidence of contamination was apparent in any of these samples. Figure 1 shows the surface water/sediment sampling locations, and Appendix A contains the surface water and sediment field data forms, which describe the appearance of the samples.

TP/ke

A/R/HIMCO/AB4



SOURCE: US EPA, AUGUST, 1986

Donohue APPROXIMATE SITE SAMPLING LOCATIONS

20026

FIELD SAMPLING PLAN
HIMCO DUMP SITE
ELKHART, INDIANA

FIGURE 1

Engineers • Architects • Scientists

TABLE 1

Sample Number	Date	T°F	pH	Conductivity ms/cm	DO mg/l
SS-1	10/17/90	69	8.11	792	6
SS-2	10/18/90	50.2	8.02	753	9
SS-3	10/18/90	48.5	8.31	704	8.4
SS-4	10/18/90	49.8	8.27	707	8.6
SS-5	10/18/90	49.6	7.93	534	8.4
SS-6	10/18/90	49.4	7.58	538	5.8
SS-7	10/18/90	48.3	7.06	431	3.2
SS-8	10/19/90	46.8	8.06	471	7.2
SS-9	10/19/90	55.6	8.06	637	7.2
SS-10	10/19/90	60.0	7.99	659	6.4
SS-11	10/19/90	61.7	8.00	693	6.7
SS-12	10/19/90	61.7	8.00	693	6.7

A/R/HIMCO/AB4

APPENDIX A

SURFACE WATER AND SEDIMENT FIELD DATA FORMS

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SURFACE WATER FIELD DATA
& SEDIMENT CONTAMINATION SURVEY

SITE IDENTIFIER NUMBER SS-1 SD-

WATER		SEDIMENT	
DATE	10/17/90	DATE	10/12/90
TIME	8:00 AM	TIME	1140
COLLECTOR	Tom Puchalski Eric Slusser	COLLECTOR	Tom Puchalski Eric Slusser

WATER DEPTH 1-foot

SAME LOCATION

pH 8.11

TEMPERATURE OF WATER 69°F

COLOR Clear

ODOR None

CLARITY Clear - some vegetation

COND 792 µS/cm

DO 6 mg/l

SEP 10/17/90 ~~Gray Sand, Black Muck~~ Lt brown Mix

~~H_2S~~ None

PHYSICAL DESCRIPTION OF SAMPLING POINT NW corner of large L shaped fish pond 15' east of corner 3' off of north shore.

ANY OTHER CHARACTERISTICS OF NOTE Sediment is light brown medium sand with a trace of sbang 3/4" pebbles.

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SURFACE WATER FIELD DATA & SEDIMENT CONTAMINATION SURVEY

SITE IDENTIFIER NUMBER SS-2 SD-C

	WATER	SEDIMENT
DATE	~~10/17/90~~ TEP 10/17/90 10/18/90	10/17/90
TIME	800 AM	1440
COLLECTOR	ERIC SLUSSER	TOM DUCHALSKI
	TOM DUCHALSKI	ERIC SLUSSER
	DOROTHEA DOWNS	
WATER DEPTH	2'	SAME LOCATION
pH	8.02	
TEMPERATURE OF WATER	50.2	
COLOR	Clear	JEP 10/17/90 ~~Lt brown~~ Grey Sand, black
ODOR	None	~~None~~ H_2S
CLARITY	Clear - Non turbid	
COND	753 µs/cm	
DO	9 mg/l	

PHYSICAL DESCRIPTION OF SAMPLING POINT 125' south of north shore of L shaped fish pond off of the west bank. Sandy marly dropoff.

ANY OTHER CHARACTERISTICS OF NOTE Sediment is organic rich

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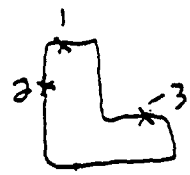
SURFACE WATER FIELD DATA
& SEDIMENT CONTAMINATION SURVEY

SITE IDENTIFIER NUMBER SS-3 SD-

	WATER	SEDIMENT
DATE	10/18/90	10/17/90
TIME	8:15	3:30 p.m
COLLECTOR	ERIC SLUSSER	TOM PUCHALSKI
	TOM PUCHALSKI	ERIC SLUSSER
	DOROTHEA DOWNS	
WATER DEPTH	1'	
pH	~~48.5°F~~ 8.31	
TEMPERATURE OF WATER	48.5 °F	
COLOR	Clear	Lt Brown Sand
ODOR	None	None
CLARITY	Clear - Non turbid	
COND	704	
DO	8.4	



PHYSICAL DESCRIPTION OF SAMPLING POINT Southeast corner of L shaped fish pond 3' south of shore for sediment 1' off shore for surface water

ANY OTHER CHARACTERISTICS OF NOTE Sandy gravel shoreline

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SURFACE WATER FIELD DATA

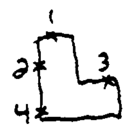
& SEDIMENT CONTAMINATION SURVEY

SITE IDENTIFIER NUMBER SS-4 SD-C

	WATER	SEDIMENT
DATE	10/18/90	10/18/90
TIME	8:35 A.M.	1415
COLLECTOR	ERIC SLUSSER	SLUSSER
	TOM PUCHALSKI	PUCHALSKI
	DOROTHEA DOWNS	
WATER DEPTH	1-foot	1-foot
pH	8.27	
TEMPERATURE OF WATER	49.8	
COLOR	Clear	Brown
ODOR	None	None
CLARITY	Clear	

707

8.6



PHYSICAL DESCRIPTION OF SAMPLING POINT SW corner of large L shaped fish pond 1-foot off west shore. Water depth drops off to 5' close to shore.

ANY OTHER CHARACTERISTICS OF NOTE Sediment consists of medium grained sand in gravelly sand gravel 3/4 - 1/8" sbang. Some marl.

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SURFACE WATER FIELD DATA
& SEDIMENT CONTAMINATION SURVEY

SITE IDENTIFIER NUMBER SS-05 SD-05

	WATER	SEDIMENT
DATE	10/18/90	10/18/90
TIME	10:55 AM	1445
COLLECTOR	ERIC SLUSSER	SLUSSER
	TOM PUCHALSKI	PUCHALSKI
	DOROTHEA DOWNS	
WATER DEPTH	1'	2'
pH	7.93	
TEMPERATURE OF WATER	49.6	
COLOR	Clear	Brown sand, black muck
ODOR	None	H_2S
CLARITY	Clear - Non turbid	
COND	534 µS/cm	
DO	8.4 mg/l	

PHYSICAL DESCRIPTION OF SAMPLING POINT Middle of south shore of small pond near fish pond

ANY OTHER CHARACTERISTICS OF NOTE Sediment - Gravelly sand & muck, gravel - most 1/2" sharp, sand med grn.

SHEET _ OF _

Donohue SURFACE WATER FIELD DATA & SEDIMENT CONTAMINATION SURVEY

SITE IDENTIFIER NUMBER: SS-C6 SD-C6

	WATER	SEDIMENT
DATE	10/18/90	10/30/90
TIME	11:15 AM	805
COLLECTOR	ERIC SLUSSER, TOM PUCHALSKI, DOROTHEA DOWNS	TOM PUCHALSKI, ERIC SLUSSER
WATER DEPTH	1'	1'
pH	7.58	
TEMPERATURE OF WATER	49.4	
COLOR	Light brown to clear	Lt brown sand
ODOR	None	None
CLARITY	Slight turbid	
COND	538	
DO	5.8	

PHYSICAL DESCRIPTION OF SAMPLING POINT ≈ 25 feet south of north shore of small pond near L shaped fish pond on west ~~bank~~ ≈ 7' offshore

ANY OTHER CHARACTERISTICS OF NOTE Sediment sample is gravelly sand, light brown medium sand 75%, angular, course angular sand 10%, 15% ½" stony gravel

SHEET _ OF __

Donohue

SURFACE WATER FIELD DATA
ē SEDIMENT
CONTAMINATION SURVEY

SITE IDENTIFIER NUMBER
SS-07
SD-07

	WATER	SEDIMENT
DATE	10/19/90	10/20/90
TIME	1135 AM	834 AM
COLLECTOR	DOROTHEA DOWNS ERIC SLUSSER TOM PUCHALSKI	TOM PUCHALSKI ERIC SLUSSER
WATER DEPTH	1'	1'
pH	7.06	
TEMPERATURE OF WATER	48.3°F	
COLOR	Light brown	Grey
ODOR	Slight H_2S	Strong H_2S
CLARITY	Slight turbid	

COND 431
DO 3.2

PHYSICAL DESCRIPTION OF SAMPLING POINT Middle of north shore of small pond in cattails.
Sheen on water - metallic grey.

ANY OTHER CHARACTERISTICS OF NOTE Sediment is fine grained angular sand with a trace of sbrd gvl ≈ ¼" dia. SM - Silty sand 20% sand

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SURFACE WATER FIELD DATA & SEDIMENT CONTAMINATION SURVEY

SITE IDENTIFIER NUMBER: 35-CB / SD-CB

	SURFACE WATER	SEDIMENT
DATE	10/19/90	10/20/90
TIME	820	920
COLLECTOR	TOM PUCHALSKI ERIC SLUSSER	TOM PUCHALSKI ERIC SLUSSER
WATER DEPTH	8"	8"
pH	8.06	
TEMPERATURE OF WATER	46.8	
COLOR	Clear	Grey
ODOR	None	None
CLARITY	Clear	
COND	471	
DO	7.2	

PHYSICAL DESCRIPTION OF SAMPLING POINT east shore of small pond north of L shaped fish pond midpoint of shore

ANY OTHER CHARACTERISTICS OF NOTE Slight sheen on water - non iridescent

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SURFACE WATER FIELD DATA

CONTAMINATION SURVEY

SITE IDENTIFIER NUMBER SS-07 SD-10

	WATER	SEDIMENT
DATE	10/19/90	10/20/90
TIME	1000	1050
COLLECTOR	TOM PUCHALSKI ERIC SLUSSER DOROTHEA DOWNS	TOM PUCHALSKI ERIC SLUSSER
WATER DEPTH	1'	
pH	8.06	
TEMPERATURE OF WATER	55.6	
COLOR	Clear	10YR 5/3 Brown
ODOR	None	None
CLARITY	Clear	
COND	637	
DO	7.2	

PHYSICAL DESCRIPTION OF SAMPLING POINT Midpoint of north shore of quarry 2 feet offshore

ANY OTHER CHARACTERISTICS OF NOTE Sediment is silt, sand (SM) with a trace of 1/2" sbrd gvl

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SURFACE WATER FIELD DATA & SEDIMENT CONTAMINATION SURVEY

SITE IDENTIFIER NUMBER SS-10 SD-10

	WATER	SEDIMENT
DATE	10/19/90	10/20/90
TIME	1020	1118 AM
COLLECTOR	ERIC SLUSSER TOM PUCHALSKI DOROTHEA DOWNS	TOM PUCHALSKI ERIC SLUSSER
WATER DEPTH	1′	1′
pH	7.99	
TEMPERATURE OF WATER	60.0	
COLOR	Clear	10 YR 5/3 Brown
ODOR	None	None
CLARITY	Clear	
COND	659 µS/cm	
DO	6.4 ~~µS/cm~~ mg/l	

PHYSICAL DESCRIPTION OF SAMPLING POINT Midpoint of east shore at quarry 2′ offshore

ANY OTHER CHARACTERISTICS OF NOTE Sediment is silty sand (SM) with a trace of ¼″ stone gvl.

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SURFACE WATER FIELD DATA
& SEDIMENT CONTAMINATION SURVEY

SITE IDENTIFIER NUMBER SS-11 SD-11

	WATER	SEDIMENT
DATE	10/19/90	10/20/90
TIME	1050	1150
COLLECTOR	TOM PUCHALSKI	TOM PUCHALSKI
	ERIC SLUSSER	ERIC SLUSSER
	DOROTHEA DOWNS	
WATER DEPTH	1-foot	1-foot
pH	8.00	
TEMPERATURE OF WATER	61.7	
COLOR	Clear	10YR 5/3 Brown & N2/Blac
ODOR	None	None
CLARITY	Clear	
COND	693	
DO	6.7	

PHYSICAL DESCRIPTION OF SAMPLING POINT 2 feet off south shore of Quarry near midpoint of shore in bay near fence gate at south of quarry

ANY OTHER CHARACTERISTICS OF NOTE Sediment is GW gravelly sand 70% 1/2-1/4" sbrd grvl, 30% fn-crs ang sand Some black silt in areas mixed with gravelly sand.

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SURFACE WATER FIELD DATA
& SEDIMENT CONTAMINATION SURVEY

SITE IDENTIFIER NUMBER SS-12 SD-12

	WATER	SEDIMENT
DATE	10/19/90	10/20/90
TIME	1110	1227
COLLECTOR	TOM PUCHALSKI ERIC SLUSSER DOROTHEA DOWNS	TOM PUCHALSKI ERIC SLUSSER
WATER DEPTH	1'	1'
pH	8.00	
TEMPERATURE OF WATER	61.7°F	
COLOR	Clear	10 YR 5/3 Brown
ODOR	None	None
CLARITY	Clear	
COND	693 µS/cm	
DO	6.7 mg/l	

PHYSICAL DESCRIPTION OF SAMPLING POINT Midpoint of west shore of quarry, ≈2 feet off shore

ANY OTHER CHARACTERISTICS OF NOTE sediment is gravelly sand, 70% fn grained angular sand 30% sbrd gvl 1/4 - 1/2", some 3" - not included in sample

TECHNICAL MEMORANDUM NUMBER 10

DATE: January 29, 1991

TO: Vanessa Harris - Site Manager

CC: Marcia Kuehl - RI Lead
Roman Gau - Project Manager
Mike Crosser - TSQAM

PRELIMINARY

FROM: Tom Puchalski

SUBJECT: EPA ARCS Region V Contract No. 68-W8-0093
EPA Work Assignment No. 17-5L4J
Donohue Project No. 20026.024
Himco Dump

TEST PITS

Introduction

Twenty test pits were excavated at the Himco Dump Site in Elkhart, Indiana, on November 28, 29, 30, and December 1 to determine if metal drums are buried at the site. All excavations were carried out in Level B personal protection. Excavations were dug by Chris Goodwin and Mike Donohue of John Mathes and Associates, Inc. Air monitoring of the excavation and logging of the pit were done by Tom Puchalski of Donohue & Associates, Inc. Perimeter monitoring downwind of the excavation was done by Anya Kirykowicz of Donohue & Associates, Inc. The purpose of this memo is to describe the test pit excavation methods and results as they relate to the Final Field Sampling Plan.

Methods

Test pit excavation locations were determined by Rob Stenson and Tom Puchalski of Donohue & Associates, Inc., from a magnetic anomaly map produced for the site by STS Consultants. Excavation procedures are described in Section 4.9 of the Final Field Sampling Plan, Himco Dump Remedial Investigation/Feasibility Study, Elkhart, Indiana.

A separate memorandum provided by STS Consultants describes the field and data evaluation methods they used to perform the EM, Magnetic survey, and produce anomaly maps (Appendix A).

Once the locations of the test pits were determined and marked on the magnetic anomaly map, their locations were staked in the field by reference to the site survey grid stakes. After defining the work zone with caution tape and setting up the Level B equipment, the excavation was ready to begin. As the excavation proceeded, the Donohue geologist described the types of waste and soil being excavated by completing a trench log. Readings on air monitoring equipment were periodically recorded on an atmospheric monitoring log. Air monitoring was also performed continuously by a second person at the downwind side of the excavation outside of the work zone. Readings on a PID and OVA, H_2S, $\%O_2$, LEL, and CO were all monitored. Photographs were taken of large metal objects or other objects of significance. The bottom of the pit was defined by reaching the water table or approximately 15 feet, whichever was shallower. Upon completion of the pit, a measuring tape was used to define the depth of the excavation and the depths to any significant waste or soil horizons. Following the completion of trench logs, the excavation was immediately backfilled. Prior to surveying in the trench locations, all were staked with wooden lath and survey tape.

Upon demobilization from the site, the backhoe was decontaminated by steam cleaning at the decontamination pad. Wastewater generated from steam cleaning activities was collected by the decontamination pad and pumped by sump pump from the collection pit to the on-site frac tank.

Deviations

The backhoe was decontaminated once before demobilization from the site. Decontamination was not required upon mobilization or in between test pit locations as described in the Final Field Sampling Plan because no sampling for chemical analysis was performed, and all test pit locations were on-site in areas of former waste disposal.

Summary of Results

Twenty test pit locations were excavated. Each test pit was twenty-five feet long. Some test pit locations were along the same direction and a direct extension of adjoining test pits, in some cases, producing up to a 100-foot long continuous trench. Test pit locations are provided in Figure 1. Completed trench log forms are included in Appendix B. X

Other than a few scarce 55-gallon drum lids, one rusted and crushed 55-gallon drum which may have been a burn barrel for garbage, and a few 25-gallon crushed drums, no significant buried drums were discovered. Other metallic objects were discovered which can account for the observed magnetic anomalies. Excavated metallic objects consist of scrap metal strips and angle iron, pipes, sheet metal, refrigerator condensers, wire, lawn mower parts, car bumpers, metal boxes, car mufflers, and pails.

A summary of the information contained in the trench logs and atmospheric monitoring logs follows.

Trench 1-4

Trenches 1-4 were excavated from northeast to southwest adjacent to each other to form one long 100-foot trench along hummocky terrain. Two iron beams, concrete, and metal pipe was protruding from the ground surface in several places. Grass covered hummocks were approximately six feet higher than the surrounding terrain. The spoils were piled on the down-wind east side of the trench. The trench was originally approximately 5 feet wide but this dimension widened to 10 feet at the north and south 25 feet due to cave-in. The trench depth varied from 6 feet on the northeast end to 12 feet on the southwest.

The stratigraphy of TP-1 through TP-4 ~~(See log Appendix A)~~ can be summarized as follows. A thin 0.5 to 2.0-foot layer of silty sand topsoil fill overlies a white calcium sulfate layer which grades to black at its base. The calcium sulfate layer pinches out in TP-2 but is present as a brown and white silt layer in TP-3. It was not present in TP-4, but is correlative with black and white stringers 2 to 0.5 feet thick.

Municipal waste, from 2 to 5 feet thick, described in detail in the trench log, is present below the calcium sulfate. Water began flowing into the trench at 7 feet so the trench was not excavated deeper on this end. As the trench excavation proceeded south, no new water sources began flowing. TP-2, therefore, was excavated deeper to 11 feet. The waste layer pinched to about one foot thick in TP-2.

Metal objects were found which can explain the anomaly mapped for this area. Scrap metal strips, steel I-beams, metal pipe, sheet metal, and two drum lids were found within the waste layer in TP-1, 2, 3, and 4.

Air Monitoring

Air monitoring of TP-1 through TP-4 produced a high reading of 30 to 40 ppm and a low of 2 ppm on an OVA. No positive readings were produced on the PID, radiation detector, or lumidor. OVA readings down-wind of the trench at the work zone boundary were sporadic. Reading between 10 and 60 ppm lasted about 5 seconds spaced 1 to 2 minutes apart. Readings were not detected 250 feet down wind of the trench.

Trench 5-6

Trenches 5 and 6 were excavated adjoining one another to form one 50-foot trench oriented north-south. This trench was located in hummocky grass covered terrain similar to the location of TP1-TP4. Excavation spoils were piled on the eastern (down wind) side of the trench. The trench width was 5 feet. The depth extended to 14 feet.

The first foot of the profile of these two trenches consist of brown silty sand topsoil fill. Below the topsoil is calcium sulfate which varied in thickness from one to 9 feet. Below the calcium sulfate lenses is black silty sand with wood, plastic wrap, and sheet metal distributed throughout.

The water table was not reached in this excavation. The water source at the north end of TP-5 was perched water contained within the void space of the waste layer from 2-6 feet.

The majority of the metal objects were found at 8 feet in TP-5 and 6. The objects consist primarily of sheet metal. A small metal oven or refrigerator was excavated from TP-6 near the north end at approximately 8 feet.

Atmospheric Monitoring

Thé OVA was the only air monitoring instrument which had readings above background. Readings from 30 to 100 ppm were registered at the excavation. Downwind perimeter monitoring registered 20-30 ppm, 50 feet from the trench (east), 2 to 3 ppm, 150 feet east, and 0 at 250 feet. Higher readings averaging 30 to 40 ppm and instantaneous sporadic readings greater than 100 ppm were observed at the 6-foot depth in TP-5.

Trench 7-8

Trenches 7-8 were excavated adjoining one another to form one north-south trench extending 50 feet. These two trenches were excavated approximately 5 to 7 feet wide and stopped at 12 feet where the water table was encountered. The water table was reached before the bottom of the waste; groundwater is flowing through the waste at this location.

The silty sand topsoil is only a few inches thick at this location. Below the topsoil is about 1 feet of calcium sulfate. From 1 feet to the bottom of the pit at 12 feet is mixed waste consisting of paper, wood, fiber templates, plastic bags, black sand, Alka-Seltzer wrappers, bottles and caps, toothpaste samples, and glass bottles.

Metal objects include one unmarked 55-gallon and one unmarked 25-gallon drums. More significant metal objects include metal pipe found at 2 feet in TP-8, car bumpers, refrigerator compressors, sheet metal,and aerosol cans. Markings on aerosol cans suggests one source as Sudden Beauty hair spray and Dristan Hay Fever Spray were most common. Three 55-gallon drum lids were also found. Only one had legible markings marked "Aliphatic Resin."

Native yellow brown sand was encountered near the south end of TP-8 from the surface to the base of the excavation at 12 feet.

Atmospheric Monitoring

Sporadic readings of up to 700 ppm were observed on the OVA. Thirty-two ppm H_2S were observed on the lumidor which periodically set off the instrument alarm. H_2S readings were also sporadic; readings were highest during excavation of calcium sulfate. Perimeter monitoring of the downwind side of the trench exhibited readings of 30 to 50 ppm on the OVA at the work zone tape, and 3 to 6 ppm at 75 feet downwind of the work zone tape.

Trench 9

Trench 9 was excavated from northeast to southwest extending 25 feet. The ground surface at this area is flat and sparsely grass covered. Calcium sulfate is present at the ground surface. The silty sand topsoil is approximately 6 inches thick. Below this thin layer of topsoil is 2.5 feet of calcium sulfate. From 3 to 5 feet, waste was excavated consisting of tires, wood, paper, black sand, Alka-Seltzer wrappers, rubber 1/8-inch bands, and plastic bags.

Few metal objects were excavated from this pit. Three unmarked 55-gallon drums lids and bundles of wire were excavated at about 4 feet.

A lower calcium sulfate layer extends half way across the trench from the northeast end from 5 to 8 feet in depth. Mixed paper and plastic waste make up the majority of the waste from 8 to 12 feet. The water table was encountered at 12 feet where the excavation stopped.

The lower limit of the waste was not reached before the water table was encountered. Groundwater is flowing through waste at this location. As the bottom of the trench filled with groundwater, gas was bubbling up through the water originating from the waste at the base of the trench.

Atmospheric Monitoring

Readings of up to 500 ppm were observed on the OVA during the excavation of TP-9. Most of the OVA readings were from 20 to 100 ppm at the trench. Readings of H_2S up to 38 ppm were observed during excavation and piling of calcium sulfate at the surface. Perimeter monitoring at the downwind border of the work zone exhibited OVA readings ranging from 2 to 90 ppm. Readings 100 feet further downwind were 2 to 7 ppm, and readings 200 feet downwind were 0.8 to 3 ppm. No perimeter readings above background were detected for H_2S or any other monitored parameters.

Trench 10-11

Trenches 10-11 were excavated oriented north-south with TP-10 on the north adjoining TP-11 on the south to form one 50-foot long trench. Spoils were piled on the east side of the trench.

TP 10-11 is located in a partially grass-covered area. The topsoil is about 1 foot thick consisting of yellow brown silty sand. A lens of waste extends about 12 feet south of the north boundary of TP-10. The lens is approximately 2 feet thick and consists of plastic bags, glass and plastic bottles, wood, and paper. The rest of the trench consists of white, black, and gray layers of calcium sulfate. A few scarce 1"x5" boards were found scattered throughout the calcium sulfate. Groundwater was encountered at 8 feet before the base of the calcium sulfate was reached. Very little metal was discovered in this trench. One piece of sheet metal was located 10 feet south of the north edge of TP-10 at 3 feet.

Atmospheric Monitoring

Positive readings of H_2S and OVA were observed during excavating of TP 10-11. No other instruments had readings above background. OVA readings ranged from 10 to 200 ppm at the trench and 0 to 90 ppm downwind of the trench at the work zone tape. H_2S readings ranged from 2 to 14 ppm at the trench with no H_2S detected downwind of the trench outside of the work zone.

Trench 12-13

TP '12-13 were excavated at the south end of the landfill cap at a relatively flat grass-covered area. Two 25-foot long, 5-foot wide trenches were oriented along a northeast trend and adjoined to create one 50-foot long trench. Excavation stopped at 10 feet when the water table was encountered.

Approximately 6 inches of yellow brown silty sand topsoil fill was found covering about 7.5 feet of white calcium sulfate. Some of the fracture faces of the calcium sulfate were yellow. This may relate to the H_2S atmospheric readings obtained during excavation of this material. This layer is relatively thick in this trench when compared to other trenches excavated on-site. At 8 feet, a 1-foot thick layer of waste was encountered within the calcium sulfate. The waste consists of wood and paper with lesser amounts of sheet metal, rubber sheets, and Alka-Seltzer wrappers. Groundwater was observed to be pouring out of void spaces associated with the waste layer. This black groundwater poured into the bottom of the trench as the excavation proceeded. Gases were observed bubbling up through the groundwater from the calcium sulfate at the base of the trench.

Atmospheric Monitoring

Positive readings of H_2S and readings on the OVA were observed during trenching of TP 12-13. H_2S readings range from 1 to 46, averaging about 7 at the trench. No downwind H_2S was detected during perimeter monitoring outside the work zone. OVA readings range from 20- greater than 1,000 ppm, averaging about 200 ppm at the trench. Perimeter OVA ranged from 10 to 50 ppm, with average readings about 10 ppm. Readings of 1.5 to background were observed 100 feet downwind of the trench.

Trench 14-15

TP 14-15 were excavated at the southwest edge of the landfill cap at a grass-covered flat area immediately west of the slope east up to the top of the landfill cap. The western boundary of fill was excavated at TP 14-15. Two 25-foot long trenches were oriented east-west and adjoined to make one 50-foot long excavation. Spoils were piled on the north side of the trench. The trench was excavated to 5 feet wide, but sloughing of the sidewalls during excavation widened the trench to up to 15 feet in places.

The stratigraphic profile begins with approximately 1-foot of brown to yellow brown silty sand topsoil. Below this layer is a 1 foot thick layer of white to gray hardened calcium sulfate. Native sand was encountered from 2 to 9 feet. Several zones of black sand approximately 6 inches thick and 6 feet long were found throughout the buff to brown native sand. No water was encountered in TP-14. As the excavation proceeded east, the depth was decreased to 6 feet since no fill material was present below the calcium sulfate at one to two feet. At the eastern-most edge of TP-15, wood debris, a refrigerator compressor, metal pipe, and sheet metal debris were discovered at about 4 feet in depth. Groundwater began pouring out of this area of debris and proceeded to fill the trench with water. Backfilling of the trench began as soon as the water began pouring out. By the time the backfilling was complete, there was excess volume of groundwater which was displaced by backfill material so that a several inch deep by 30-foot wide puddle was left at the west end of TP-14 on the ground surface.

Atmospheric Monitoring

No abnormal readings were observed other than OVA detections. The OVA readings ranged from 1 to 400, averaging less than 20 ppm. Downwind perimeter OVA readings ranged from 0 to 90 ppm, averaging sporadic readings of 20 ppm. OVA readings were sporadic from 1 to 5 ppm 100 feet downwind. The absence of H_2S readings during the excavation of this trench may be related to the relatively little amount of calcium sulfate encountered.

Trench 16

One 25-foot long trench was oriented on a northwest trend at this location. Approximately one-half foot of brownish yellow fine-grained silty sand topsoil was found overlying a one-foot thick layer of calcium sulfate. Waste was excavated below the calcium sulfate. The waste consists of black wood, paper, plastic and glass bottles, rubber, plastic bags, and smaller amounts of sheet metal, metal pipe, and an empty gas container from a small engine. Black groundwater was reached at 4 feet so the excavation stopped at this depth. A few extra scoops were excavated to 6 feet at the southeast end of the trench. These saturated spoils were not removed, but piled in the northwestern end of the trench. This extra excavation was done to attempt to define the lower limit of the waste. Waste continued beyond 6 feet deep.

Atmospheric Monitoring

Reading of H_2S and positive readings on the OVA were observed during excavation of TP-16. H_2S readings range from 2 to 27 ppm at the trench, but were not detected downwind outside of the work zone. OVA readings ranged from 10 to 500 ppm. Perimeter OVA readings ranged from background to 12 ppm. No OVA readings were observed 50 feet downwind of the trench.

Trench 17

Trench TP-17 is oriented on an east-west trend extending 25 feet. The trench was approximately 5 feet wide. A thin (several inch) layer of yellow brown silty sand topsoil fill covers an 8-inch thick layer of calcium sulfate. Below the calcium sulfate, waste was encountered. Approximately 80 percent of the waste is rubber sheets and bands with minor paper, wood, glass bottles, and minor corroded sheet metal and aluminum bars at less than 2.5 feet. Groundwater was encountered at 2 feet in TP-17, so the excavation was stopped at this depth.

Atmospheric Monitoring

OVA readings up to 2 ppm were observed during trenching of TP-17. No other readings were observed above background on any air monitoring instruments either at the trench or downwind of the trench at the work zone perimeter.

Trench 18

TP-18 is oriented along an east-west trend. The excavation was approximately 5 feet wide and 25 feet long. A thin veneer of sandy topsoil covers about an 8-inch thick layer of calcium sulfate. Waste was excavated below the calcium sulfate layer. The waste consists of paper, plastic, rubber, glass, cardboard, one plastic unmarked, empty 55-gallon drum, and metal objects such as a car bumper, and 3x3x5-foot sheet metal box. Groundwater was encountered before the base of the waste at 7 feet.

Atmospheric Monitoring

The OVA was the only air monitoring device which detected air contaminants above background. OVA readings ranged from 2 to 100 ppm at the trench. OVA readings at the work zone boundary downwind of the trench were sporadic ranging from 1 to 80 ppm . One hundred feet downwind, the OVA readings were down to background.

Trench 19

TP-19 is oriented slightly northeast trending. It is 25 feet long and approximately 5 feet wide. It is located at the northwest corner of the landfill cap.

The stratigraphic column begins with 1 foot of black, organic rich topsoil. From 1 foot to 2 feet, a layer of calcium sulfate was discovered. Below the calcium sulfate layer, waste was excavated. The waste consists primarily of wood, cardboard, glass bottles, beverage cans, and plastic. Small amounts of metal were excavated at the 3-foot depth consisting of a car muffler; two 55-gallon drums lids, unmarked and corroded; and a metal pail. The water table was encountered at 9 feet before the base of the waste was reached. Waste is, therefore, within the zone of saturation at this location.

Atmospheric Monitoring

The OVA was the only air monitoring instrument which had readings above background during the excavation of TP-19. Readings at the trench ranged from background to 2 ppm. Perimeter monitoring at the downwind direction revealed sporadic readings on the OVA which ranged from 0 to 120 ppm. Readings averaged about 50 ppm. Approximately 60 feet downwind from the trench, OVA readings were down to background with sporadic pulses to 5 ppm

Trench 20

TP-20 was excavated at the northeast corner of the site south of the quarry pond. This trench was oriented along a north-south trend extending 25 feet. The trench width varied from 5 to 8 feet.

The stratigraphic profile of this trench begins with a 1-foot thick layer of brown silty sand topsoil. Below the topsoil is a 1-foot thick layer of calcium sulfate. From 2 to 11 feet, waste is present. The waste consists of paper, cardboard, plastic bags, wood, black sand, and minor glass bottles. At the base of the waste, a second calcium sulfate layer was discovered. Groundwater was flowing from the interface of the waste and underlying white to gray calcium sulfate. A crumpled piece of sheet metal, roughly 3x3-foot, was excavated from the calcium sulfate at about the 12-foot depth. The excavation was completed at 13 feet where the water table was encountered.

Air Monitoring

Readings of H_2S and detections using the OVA were the only above background values observed during the excavation of TP-20. OVA readings at the trench ranged from background to greater than 1,000 ppm. Perimeter monitoring at the outside edge of the downwind side of the trench revealed OVA readings of 20 to 80 ppm with an average of 20 ppm. One hundred feet further downwind, the OVA readings averaged 10 ppm and were down to background 150 feet downwind from the trench.

TP/ke

A/R/HIMCO/AB5

APPENDIX A

FIELD PROCEDURES AND DATA EVALUATION METHODS

FOR GEOPHYSICAL SURVEY

TECHNICAL MEMORANDUM

DATE: April 30, 1991

TO: Vanessa Harris, Site Manager

CC: Roman Gau, Project Manager
Mike Crosser, TSQAM

FROM: David L. Grumman, Project Geophysicist
STS Consultants, Ltd.

PRELIMINARY

SUBJECT: EPA ARCS Region V Contract No. 68-W8-0093
EPA Work Assignment No. 17-5L4J
Donohue Project No. 20026
STS Project No. 026.023
Himco Dump Site
Elkhart, Indiana

GEOPHYSICAL EXPLORATION PROGRAM

Introduction

STS Consultants, Ltd. (STS) was requested by Donohue to conduct combined electromagnetic and magnetic geophysical surveys at the above-referenced site. The objectives of the surveys were to identify and map anomalous zones to help target subsequent site explorations by Donohue. The survey encompassed approximately 60 acres at the Himco Dump Site. The specific geophysical survey areas include the fill areas, the unfilled margins of the dump, and a wetland remnant along the south central boundary of the landfill.

Survey Methods

The geophysical explorations consisted of combined electromagnetic terrain conductivity and magnetometer surveys.

Instrumentation

The electromagnetic (EM) survey was performed using a Geonics EM-31-DL terrain conductivity meter (EM-31) with a DL-55 data logger. The magnetometer (Mag) survey was performed using an EG&G G-856 proton procession magnetometer with two (top and bottom) sensors. The use of two sensors allows the measurement of the magnetic gradient at each survey position. A laptop field computer was used to download and process the field data during the survey. All geophysical survey instrumentation, with the exception of the field computer, were provided to STS by Donohue.

Mobilization and Field Personnel

Equipment operation was checked at STS's Northbrook, Illinois, office prior to mobilizing to the site. The geophysical survey equipment appeared to be in good working order. The STS field survey crew, Mark Stroebel, Michael Monteith, and David Grumman, arrived on-site Monday, October 22, 1990, and met with Ms. Marsha Kuehl and Mr. Tom Puchalski of Donohue to review the geophysical survey objectives and site safety procedures. At that time, a 100-foot by 100-foot staked grid was still being established on-site by a subcontract land surveyor.

Survey Procedures

EM and Mag readings were taken at 25-foot intervals along survey lines spaced every 25 feet. Distances were paced-off between each staked survey grid point. Survey line nomenclature is described further in the addendum to this memo. Consistent instrument orientations were used across the survey area. Only vertical dipole EM readings were taken, and perpendicular EM readings were not taken. Each STS instrument operator maintained a field notebook during the survey and noted conditions including surface obstructions, nearby metallic objects or structures, possible sources of electrical interference, reference points along selected survey lines (for data validation), and skipped readings.

Several base stations were established along the landfill's periphery to monitor magnetometer drift. The results of the base station readings generally showed low level drift in the magnetometer data during the field survey (+/- 75 gammas, approximate). The Mag field data were not adjusted to compensate for these low level variations during the data reduction. Selected survey points were also used to monitor drift in the EM readings; however, only negligible variations in the EM base station data were observed and drift corrections were not made.

Data Reduction

The field data were returned to sTS's Northbrook, Illinois, office for data reduction and contouring. The data reduction steps for the magnetometer data consisted of: converting field data files to binary format, merging data files, gradient processing, grid position assignments, adjustments for erroneous and/or missing data, conversion of files to contourable ASCII (x-y-z) format for contouring, and computerized data contouring. A similar procedure was used to isolate the top and bottom Mag sensor readings. The EG&G program MAGPAC was used to reduce the Mag data.

A similar data reduction sequence was used for the EM data and consisted of: grid position assignments, adjustments for erroneous or missing data, separating quadrature and in-phase readings, conversion of data files to contourable ASCII (x-y-z) format, merging data files, and data contouring. The Geonics Ltd. program DAT31Q was used for the EM data reduction.

Deviations

Two field mobilizations were required to complete the survey since the survey grid had not been completed during the first mobilization. Field data from overlapping survey lines from both field efforts were evaluated and found to be consistent and generally reproducible between mobilizations.

An analysis of the Mag gradient data showed that the top sensor malfunctioned erratically during the survey, and thereby rendered the top sensor data unusable. The erratic data occurred at unpredictable intervals and appeared related to a sensor or instrument error. The anomalous top sensor readings did not match data trends in the more stable bottom sensor data. Consequently during data reduction, the bottom sensor total field data was isolated, reduced, and contoured.

The wetland remnant area was surveyed using an approximate grid system set-up by STS since no grid had been established by the land surveyors in this area.

Summary of Results

Over 3,000 site grid points were surveyed using the magnetometer and EM techniques.

Magnetometry Results

The contoured results of the magnetic data show several magnetic anomalies on-site. Figure 1 illustrates the contoured total field data (bottom sensor) and identifies the anomalies considered significant and not related to cultural interferences. These anomalies ranged between plus or minus 1000 to 4000 gammas in magnitude. Background magnetism appeared to be approximately 56750 gammas. A partial listing of some of the larger anomalies is as follows:

- Southeast-central region, directly north of site entrance.
- South central area, approximately 300 feet north of the remnant wetland.
- West central area (10, M).

EM Results

The contoured quadrature and in-phase EM data show several very large anomalous regions on-site (50 to 500 mmhos/m). More discreet anomalies are not easily resolved from the extensive quadrature anomalies, although several more localized in-phase anomalies (10 to 40 ppt) are apparent. Background levels were considered to be in the range of 10 to 40 mmhos/m for the quadrature phase and 0 to -2 ppt for the in-phase readings. Figures 2 and 3 illustrate the contoured quadrature and in-phase EM data, respectively. The extent of the large quadrature phase anomalies appears to highlight the approximate limits of filling, and shows that the surveys did provide minimal coverage beyond the fill boundaries. The in-phase data is considered more useful in the identification and mapping of conductive waste burial areas, i.e., areas which could contain concentrations of barrels, metal scrap, or highly conductive buried wastes. A partial list of the most significant in-phase anomalies includes:

- Southeast central area, north of site entrance.
- Southeast central, northwest of site entrance.
- Northeast central, south of former grave pit.
- Entire central region of landfill.

Data from the wetland remnant do not appear to show significant anomalous Mag or EM levels, as no readings appeared to be elevated above what would be considered background levels for sand soils. The quadrature data ranged between 2 and 20 mmhos/m. The wetland data was not included in the contoured data since the wetland survey grid could not be reliably tied into the site survey grid.

RS/ke

A/O/M/CQ8

ADDENDUM TO TECHNICAL MEMORANDUM

Grid Position Nomenclature

Several survey positioning schemes were used during the survey. The land surveyors established a 100-foot by 100-foot staked grid using numbers (1-25) along the east-west axis (increasing eastward), and letters (A-U) along the north-south axis (increasing northward). Station A-25 was very close to the southeast corner of the survey area. STS adopted a geophysical survey line/station reference scheme by designating land survey line No. 25 as geophysical survey line 100, with the line numbers decreasing by 1 for each survey line moving west. Geophysical station numbers were simply the linear distance along each survey line north of the A line, where the A line equals 0 north. Finally, during data reduction, line numbers were reassigned to reflect Easting/Northing distances, in feet, by designating station A-25 equal to station 10,000 East, 0 North. The following table schematically presents the line numbering:

Survey Line Reference Nomenclature

Land Surveyors Staked Location	Geophysical Field Survey	Geophysical Contour Coordinates
Easting	Easting	Easting
25	100	10,000
	99	9,975
	98	9,950
	97	9,925
24	96	9,900
	95	9,875
--	--	------
2	1	7,550
1	0	7,525
ns	201	7,475
ns	202	7,450

ns: Not Staked

The northing grid spacing was 25 feet, however, the EM meter automatically incremented/decremented this interval. The northing interval is irrelevant to the Magnetometer until data reduction. The range of northing coordinates for the survey area is 0 feet (southeast corner of site) to 2,050 feet (northwest corner of site).

Computer Data Files

The enclosed diskettes contain the following data:

Disk	Files	Comment
3 1/2" Diskette	HHimco1.new,..., HHimco19.new DHimco1.new,...,	Reduced EM Data files for using DAT31Q
	Himco1.dat,..., Himco16.dat	Raw Mag Data files (unreduced)
5 1/4" Diskette	Himco1VQ.xyz	x-y-z data file for EM quadrature data
	Himco1VI.xyz	x-y-z data file for EM in-phase data
	HimcoMG.dat	x-y-z data file for magnetometer Gradiometer data (erroneous)
	Himcobot.dat	x-y-z data file for bottom sensor magnetometer data

A/O/M/CQ8

APPENDIX B

~~MAGNETIC ANOMALY MAP~~

TEST PIT LOGS

TRENCH LOG FORM

Donohue

CLIENT: USEPA
PROJECT: HIMCO DUMP
PROJECT NO.: 20026.023
DATE: 11/30/90
GRID COORD.: START - N ____ E ____ N ____ E ____
END - N ____ E ____ N ____ E ____
CONTROL MONUMENT GRID COORD.: N ____ E ____ N ____ E ____
ELEVATION, TOP OF TRENCH: N 12 13 S

SHEET 1 OF 1
EXCAVATOR: Mathes
LOG BY: TEP
TRENCH NO.: 12 & 13
TRENCH LENGTH: 0 FT TO 30 FT
TRENCH WIDTH: 5 ft

STRATA CHANGE OF WATER LEVEL	DEPTH	TRENCH LENGTH (FT)	DRUM QUANTITY	REMARK NO.
		1 2 3 4 5 6 7 8 9 0		
		Yellowish brown silty sand topsoil fill		
	5	CaSO4 white with some fracture faces yellow		
		Docs, paper, sheet metal — sheet metal — Rubber sheets, wood		
	10	CaSO4 — Alka Seltzer wrapper	Fallen	
	15			
	20			
	25			

REMARKS:

TRENCH LOG FORM

Donohue

CLIENT: USEPA
PROJECT: HIMCO
PROJECT NO.: 20026.023
DATE: 11/30/90
GRID COORD.: START - N ____ E ____ N ____ E ____
END - N ____ E ____ N ____ E ____
CONTROL MONUMENT GRID COORD.: N ____ E ____ N ____ E ____
ELEVATION, TOP OF TRENCH: W 14 15 E

SHEET 1 OF 1
EXCAVATOR: Mathes
LOG BY: Tom Puchalski
TRENCH NO.: 14 & 15
TRENCH LENGTH: 0 FT TO 50 FT
TRENCH WIDTH: 5-7 Ft

STRATA CHANGE OF WATER LEVEL	DEPTH	TRENCH LENGTH (FT)	DRUM QUANTITY	REMARK NO.
		1 2 3 4 5 6 7 8 9 0		
		Brown to lt brn silty sand TOPSOIL - ROOTS		
		Hardened Clay - White to gray		
		6" thick		
		Natural Sand Buff to brown with black layers, unsaturated	Waste Metal Debris Flowing Water Metal Debris	
	5			
	10			
	15			
	20			
	25			

REMARKS: Water began pouring from east end of trench and nearly filled trench by the time the backfill was complete. Rate of discharge did not slow during the 10 minutes of observation.

TRENCH LOG FORM

Donohue

CLIENT: USEPA
PROJECT: Himco
PROJECT NO.: 20063.033
DATE: December 1, 1990
GRID COORD.: START - N ___ E ___ N ___ E ___
END - N ___ E ___ N ___ E ___
CONTROL MONUMENT GRID COORD.: N ___ E ___ N ___ E ___
ELEVATION, TOP OF TRENCH: NW

SHEET 1 OF 1
EXCAVATOR: Mathes
LOG BY: TEP
TRENCH NO.: TP-16
TRENCH LENGTH: 0 FT TO 37 FT
TRENCH WIDTH: 5 feet

SE

STRATA CHANGE OF WATER LEVEL	DEPTH	TRENCH LENGTH (FT)	DRUM QUANTITY	REMARK NO.
		1 2 3 4 5 6 7 8 9 0		
		Cover		
		Black - Wood, paper, bottles, rubber, plastic bags. Trace of sheet metal and metal pipe		
	5			
	10			
		Brownish tan TOPSOIL, finegrained silty sand, moist		
	15			
	20			
	25			

REMARKS: Metal - Sheet metal - minor - one sheet, metal gas can from lawn mower with hole in it, ~~see three~~ two 1" x 2' metal pipes. Shallow groundwater did not allow deeper excavation

TRENCH LOG FORM

Donohue

CLIENT: USEPA

PROJECT: Himco

PROJECT NO.: 20026.073

DATE: 12/1/90

GRID COORD.: START - N ____ E ____ N ____ E ____

END - N ____ E ____ N ____ E ____

CONTROL MONUMENT GRID COORD.: N ____ E ____ N ____ E ____

ELEVATION, TOP OF TRENCH: W E

SHEET 1 OF 1

EXCAVATOR: JMA

LOG BY: TEP

TRENCH NO.: 17

TRENCH LENGTH: 0 FT TO 35 FT

TRENCH WIDTH: 5

STRATA CHANGE OF WATER LEVEL	DEPTH	TRENCH LENGTH (FT) 1	2	3	4	5	6	7	8	9	0	DRUM QUANTITY	REMARK NO.
		cover											
		80% Rubber sheets & bands, rest - paper, wood, glass, trace [illegible] - That's fill											
	5	Ylw Brn silty sand (SM) Topsoil, [illegible], moist											
	10												
	15												
	20												
	25												

REMARKS:

TRENCH LOG FORM

Donohue

CLIENT: USEPA
PROJECT: HIMCO
PROJECT NO.: 20026.023
DATE: 12/1/90
GRID COORD.: START - N ___ E ___ N ___ E ___
END - N ___ E ___ N ___ E ___
CONTROL MONUMENT GRID COORD.: N ___ E ___ N ___ E ___
ELEVATION, TOP OF TRENCH: W

SHEET 1 OF 1
EXCAVATOR: Mathes
LOG BY: Tom Michalski
TRENCH NO.: TP-13
TRENCH LENGTH: 0 FT TO 35 FT
TRENCH WIDTH: 5 ft

E

STRATA CHANGE OF WATER LEVEL	DEPTH	TRENCH LENGTH (FT) 1	2	3	4	5	6	7	8	9	0	DRUM QUANTITY	REMARK NO.
					topsoil	CaSO4							
		Municipal Waste & Paper, plastic, rubber, glass, cardboard											
		x 1 plastic 55 gal drum											
	5						x - Car bumper, & other large metal objects (3x3x5 sheet metal box)						
	10												
	15												
	20												
	25												

REMARKS:

TRENCH LOG FORM

Donohue

CLIENT: US EPA
PROJECT: Himco
PROJECT NO.: 20026.023
DATE: 12/1/90
GRID COORD.: START - N ____ E ____ N ____ E ____
END - N ____ E ____ N ____ E ____
CONTROL MONUMENT GRID COORD.: N ____ E ____ N ____ E ____
ELEVATION, TOP OF TRENCH:

SHEET 1 OF 1
EXCAVATOR: JMA (John Mathes & Assoc)
LOG BY: JEP
TRENCH NO.: TP-11
TRENCH LENGTH: 250 FT TO 75 FT
TRENCH WIDTH: 5

W E

STRATA CHANGE OF WATER LEVEL	DEPTH	TRENCH LENGTH (FT) 1	2	3	4	5	6	7	8	9	0	DRUM QUANTITY	REMARK NO.
				Black organic rich Topsoil				White CaSO4					
				* Muffler, drum lids, pail									
	5	Wood, cardboard, trash, bottles, cans, glass, plastic											
	10												
	15												
	20												
	25												

REMARKS:

TRENCH LOG FORM

Donohue

CLIENT: US EPA
PROJECT: Himco Dump
PROJECT NO.: 20036.023
DATE: 12/1/90
GRID COORD.: START - N ___ E ___ N ___ E ___
END - N ___ E ___ N ___ E ___
CONTROL MONUMENT GRID COORD.: N ___ E ___ N ___ E ___
ELEVATION, TOP OF TRENCH: N

SHEET 1 OF 1
EXCAVATOR: JHA
LOG BY: TEP
TRENCH NO.: 30
TRENCH LENGTH: 0 FT TO 25 FT
TRENCH WIDTH: 5-8 FT

STRATA CHANGE OF WATER LEVEL	DEPTH	TRENCH LENGTH (FT)	DRUM QUANTITY	REMARK NO.
		TOPSOIL - Brown silty sand		
		C. SU		
	5	Paper, cardboard, plastic bags, minor glass bottles, wood, black sand		
	10	WATER AT INTERFACE		
		White to gray CaSO4		
		Crumpled sheet metal - Pictoll 7	Billow	
	15			
	20			
	25			

REMARKS:

TRENCH LOG FORM

Donohue

CLIENT: USEPA
PROJECT: HIMCO
PROJECT NO.: 20276.023
DATE: 11/28/90
GRID COORD.: START - N ____ E ____ N ____ E ____
END - N ____ E ____ N ____ E ____
CONTROL MONUMENT GRID COORD.: N ____ E ____ N ____ E ____
ELEVATION, TOP OF TRENCH:

SHEET 1 OF 1
EXCAVATOR: MATHES
LOG BY: TEP
TRENCH NO.: TP-J
TRENCH LENGTH: 0 FT TO 25 FT
TRENCH WIDTH: 5 ft to 10 ft where caved

STRATA CHANGE OF WATER LEVEL	DEPTH	TRENCH LENGTH (FT) 1 2 3 4 5 6 7 8 9 0	DRUM QUANTITY	REMARK NO.
		Brn silty sand topsoil fill 10YR 6/6 w/ with [illegible]		
		White SILT grading to blk at base		
		Black debris, saturated, bricks, wood, metal scraps, wire, railroad ties, trace Alka-Seltzer bottles, Plastic bag layer, [illegible] here		
	5	Mauve looking paste-like		
		water flows into trench from here [illegible] south		
		Bottom		
	10			
	15			
	20			
	25			

REMARKS:

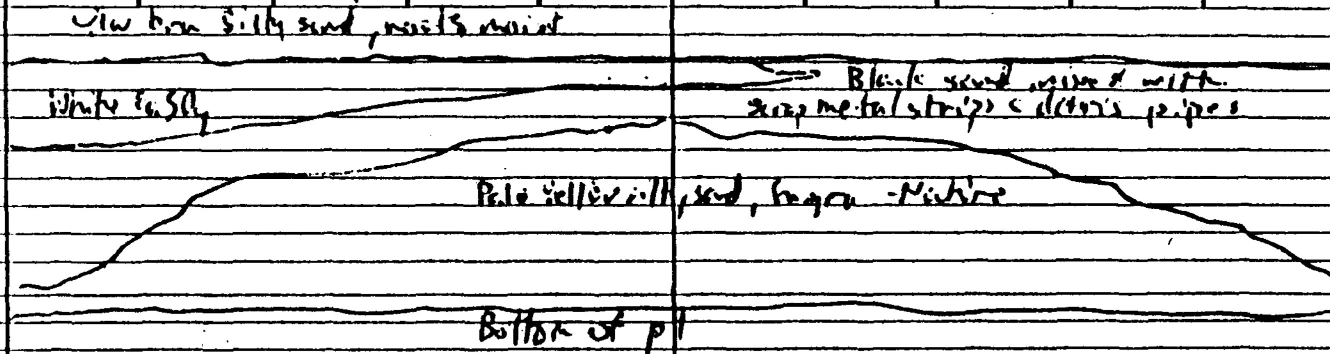
TRENCH LOG FORM

Donohue

CLIENT: USEPA
PROJECT: HIMCO
PROJECT NO.: 20026.023
DATE: 11/28/90
GRID COORD.: START - N ____ E ____ N ____ E ____
END - N ____ E ____ N ____ E ____
CONTROL MONUMENT GRID COORD.: N ____ E ____ N ____ E ____
ELEVATION, TOP OF TRENCH:

SHEET 1 OF 1
EXCAVATOR: Mathes
LOG BY: TEP
TRENCH NO.: TP-2
TRENCH LENGTH: 25 FT TO 50 FT
TRENCH WIDTH: 5 ft

STRATA CHANGE OF WATER LEVEL	DEPTH	TRENCH LENGTH (FT) 1 2 3 4 5 6 7 8 9 0	DRUM QUANTITY	REMARK NO.
	5			
	10			
	15			
	20			
	25			



REMARKS:

TRENCH LOG FORM

Donohue

CLIENT: USEPA
PROJECT: HIMCO
PROJECT NO.: 20036.023
DATE: 11/28/90
GRID COORD.: START - N ____ E ____ N ____ E ____
END - N ____ E ____ N ____ E ____
CONTROL MONUMENT GRID COORD.: N ____ E ____ N ____ E ____
ELEVATION, TOP OF TRENCH:

SHEET 1 OF 1
EXCAVATOR: Mathes
LOG BY: TEP
TRENCH NO.: TP-3
TRENCH LENGTH: 50 FT TO 75 FT
TRENCH WIDTH: 5-8 ft

STRATA CHANGE OF WATER LEVEL	DEPTH	TRENCH LENGTH (FT) 1 2 3 4 5 6 7 8 9 0	DRUM QUANTITY	REMARK NO.
		Ylw brn 10YR5/6 Silty sand topsoil, moist, roots		
		Brown & white silt layer		
	5	Black sand, metal strips & screws - metal corroded, 2 drum lids, buff sand at base		
		2.5Y 7/4 Pale ylw to gray silty sand - Native soil		
	10			
	15			
	20			
	25			

REMARKS:

Donohue

TRENCH LOG FORM

CLIENT: USEPA
PROJECT: HIMCO
PROJECT NO.: 20026.023
DATE: 11/28/90
GRID COORD.: START - N ____ E ____ N ____ E ____
END - N ____ E ____ N ____ E ____
CONTROL MONUMENT GRID COORD.: N ____ E ____ N ____ E ____
ELEVATION, TOP OF TRENCH:

SHEET 1 OF 1
EXCAVATOR: Mathes
LOG BY: TEP
TRENCH NO.: TP-4
TRENCH LENGTH: 75 FT TO 100 FT
TRENCH WIDTH: 8 ft

STRATA CHANGE OF WATER LEVEL	DEPTH	TRENCH LENGTH (FT) 1 2 3 4 5 6 7 8 9 0	DRUM QUANTITY	REMARK NO.
	5	Black and white stringers (solidified sludge?) up to 2' wide 6" in brown sand Anacin Boxes - empty		
		Thin metal strips ~1" wide, metal pipe [illegible] end on north [illegible] - 3 - 4' crushed drum lids, [illegible] metal, metal pipe, sheet metal		
	10	[illegible] grey silty sand (SM) Native		
		Bottom		
	15			
	20			
	25			

REMARKS:

TRENCH LOG FORM

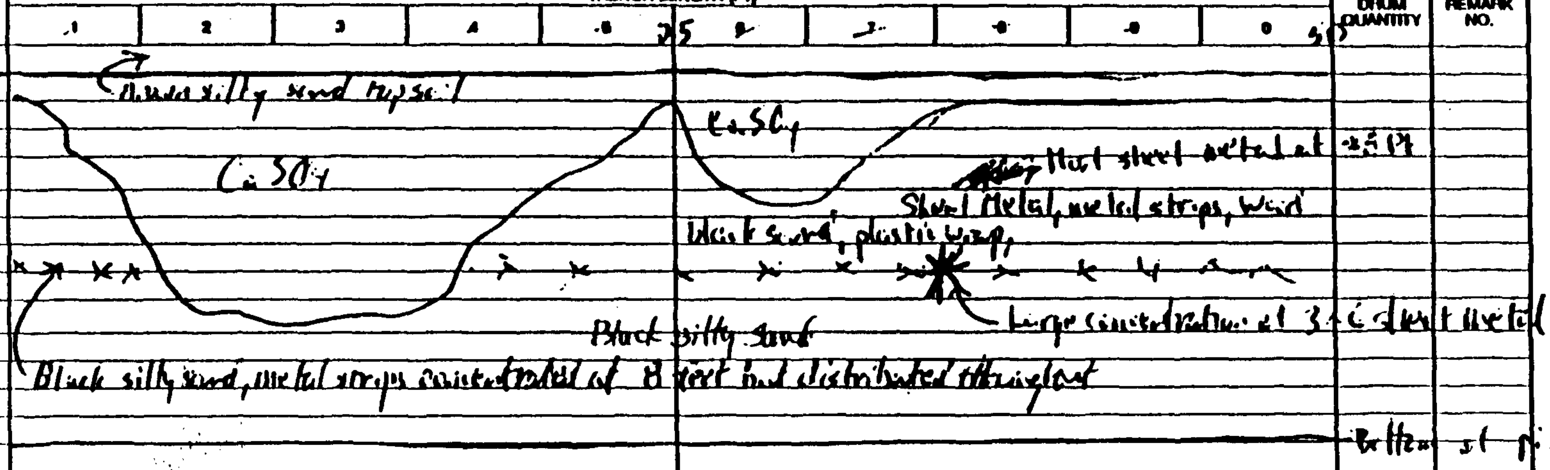
Donohue

CLIENT: USEPA
PROJECT: HIMCO
PROJECT NO.: 20026.023
DATE: 11/28/90
GRID COORD.: START - N ___ E ___ N ___ E ___
END - N ___ E ___ N ___ E ___
CONTROL MONUMENT GRID COORD.: N ___ E ___ N ___ E ___
ELEVATION, TOP OF TRENCH:

SHEET 1 OF 1
EXCAVATOR: Mathes
LOG BY: TEP
TRENCH NO.: TP 5&6
TRENCH LENGTH: 75 FT TO 100 FT
TRENCH WIDTH: 5 feet

TP-5 TP-6

STRATA CHANGE OF WATER LEVEL	DEPTH	TRENCH LENGTH (FT)	DRUM QUANTITY	REMARK NO.
	5			
	10			
	15			
	20			
	25			



REMARKS:

TRENCH LOG FORM

Donohue

CLIENT: USEPA - ARCS
PROJECT: Home Dump
PROJECT NO.: 20036.023
DATE: 11/29/90
GRID COORD.: START - N ___ E ___ N ___ E ___
END - N ___ E ___ N ___ E ___
CONTROL MONUMENT GRID COORD.: N ___ E ___ N ___ E ___
ELEVATION, TOP OF TRENCH: N

SHEET 1 OF 1
EXCAVATOR: Matthes Chris Goodwin Mike Donahue
LOG BY: TEP
TRENCH NO.: 7 & 8
TRENCH LENGTH: 0 FT TO 50 FT
TRENCH WIDTH: 5 Ft

TP-7 TP-8 S

STRATA CHANGE OF WATER LEVEL	DEPTH	TRENCH LENGTH (FT) 1–5 (TP-7)	TRENCH LENGTH (FT) 6–0 (TP-8)	DRUM QUANTITY	REMARK NO.
		Cn Soil			
		Thin layer of topsoil	Metal Pipe		
			Car Bumper, Refrigerator Compressor		
	5		Sheet Metal		
		Mixed Waste - Fiberglass templates, wood, paper, aerosol cans - Sudden Beauty Hair Spray, Diston	Holy Free Spray		
		toothpaste samples, Alka-Seltzer wrappers, plastic bags	metal pipe; Drum - 55 gallon - crushed		
	10	Oiled sand, Alka-seltzer lids	Matrix of mixed waste		
		Bottom of pit	Bottom of pit		
	15				
		Drums:			
		1 55 gallon unmarked	3 lids 1 marked Aliphatic Resin		
	20	1 25 gallon unmarked			
	25				

REMARKS:

TRENCH LOG FORM

Donohue

CLIENT: USEPA
PROJECT: Himco Dump
PROJECT NO.: 20026.033
DATE: 11/29/90
GRID COORD.: START - N ___ E ___ N ___ E ___
END - N ___ E ___ N ___ E ___
CONTROL MONUMENT GRID COORD.: N ___ E ___ N ___ E ___
ELEVATION, TOP OF TRENCH: TP-9

SHEET 1 OF 1
EXCAVATOR: Mathes
LOG BY: Tom Puchalski
TRENCH NO.: TP-9
TRENCH LENGTH: 0 FT TO 25 FT
TRENCH WIDTH: 3-6 ft

STRATA CHANGE OF WATER LEVEL	DEPTH	TRENCH LENGTH (FT) 1 2 3 4 5 6 7 8 9 9	DRUM QUANTITY	REMARK NO.
		$CaSO_4$		
	5	Tires, wood, blank, sand, plastic bags, Alka-Seltzer wrappers, Baggies, rubber in "ix" bands		
		$CaSO_4$		
	10	Paper, plastic bags		
▽		Bottom at 12'		
	15			
	20			
	25			

REMARKS: The only metal present was three 55 gallon drum lids - unmarked, and bundles of wire all at about 4' depth.

TRENCH LOG FORM

Donohue

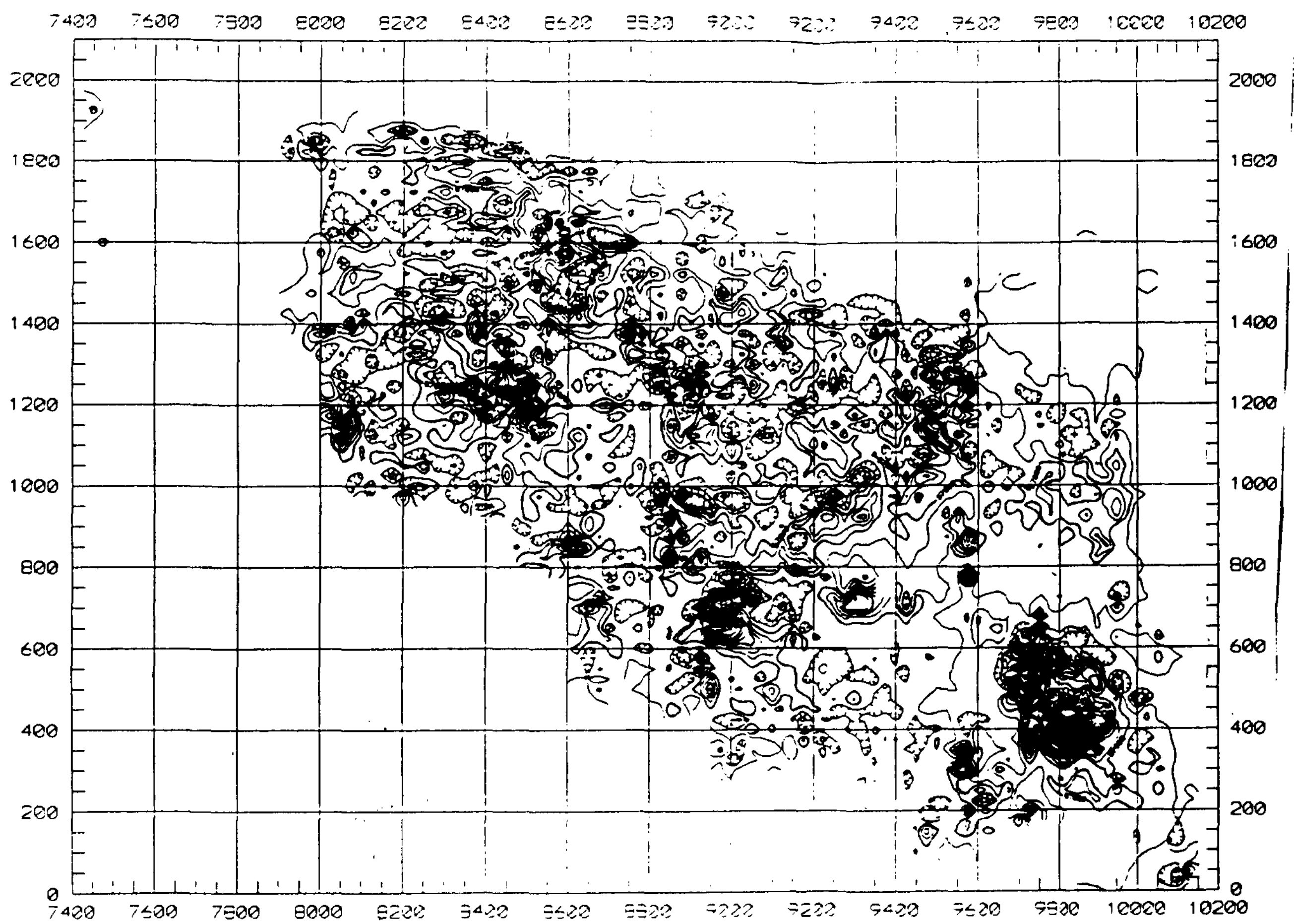
CLIENT: USEPA Himco
PROJECT: Himco Dump
PROJECT NO.: 20026.033
DATE: 11/30/98
GRID COORD.: START - N ___ E ___ N ___ E ___
END - N ___ E ___ N ___ E ___
CONTROL MONUMENT GRID COORD.: N ___ E ___ N ___ E ___
ELEVATION, TOP OF TRENCH:

SHEET 1 OF 1
EXCAVATOR: Mathes
LOG BY: Tom Puchalski
TRENCH NO.: 10 & 11
TRENCH LENGTH: 6 FT TO 50 FT
TRENCH WIDTH: 5 Ft

N 10 11 S

STRATA CHANGE OF WATER LEVEL	DEPTH	TRENCH LENGTH (FT)	DRUM QUANTITY	REMARK NO.
		Brown silty sand TOP SOIL - roots		
		Plastic bags, bottles, metal, paper		
		$CaSO_4$ - Black layers mixed with white & gray, some 1" x 5" boards.		
	5			
		Bottom of pit		
	10			
	15			
	20			
	25			

REMARKS: Very little metal. One piece of sheet metal was located 10 feet south of north edge of TP-10 at 3' depth



N

SCALE 0' 300' 600'

CONTOUR INTERVAL = 250 GAMMAS

FIGURE 1
MAGNETOMETER SURVEY
(TECHNICAL MEMO)

HIMCO DUMP
SUPERFUND SITE
ELKHART, INDIANA

MAY 1991

20028

Donohue ENGINEERS ARCHITECTS SCIENTISTS

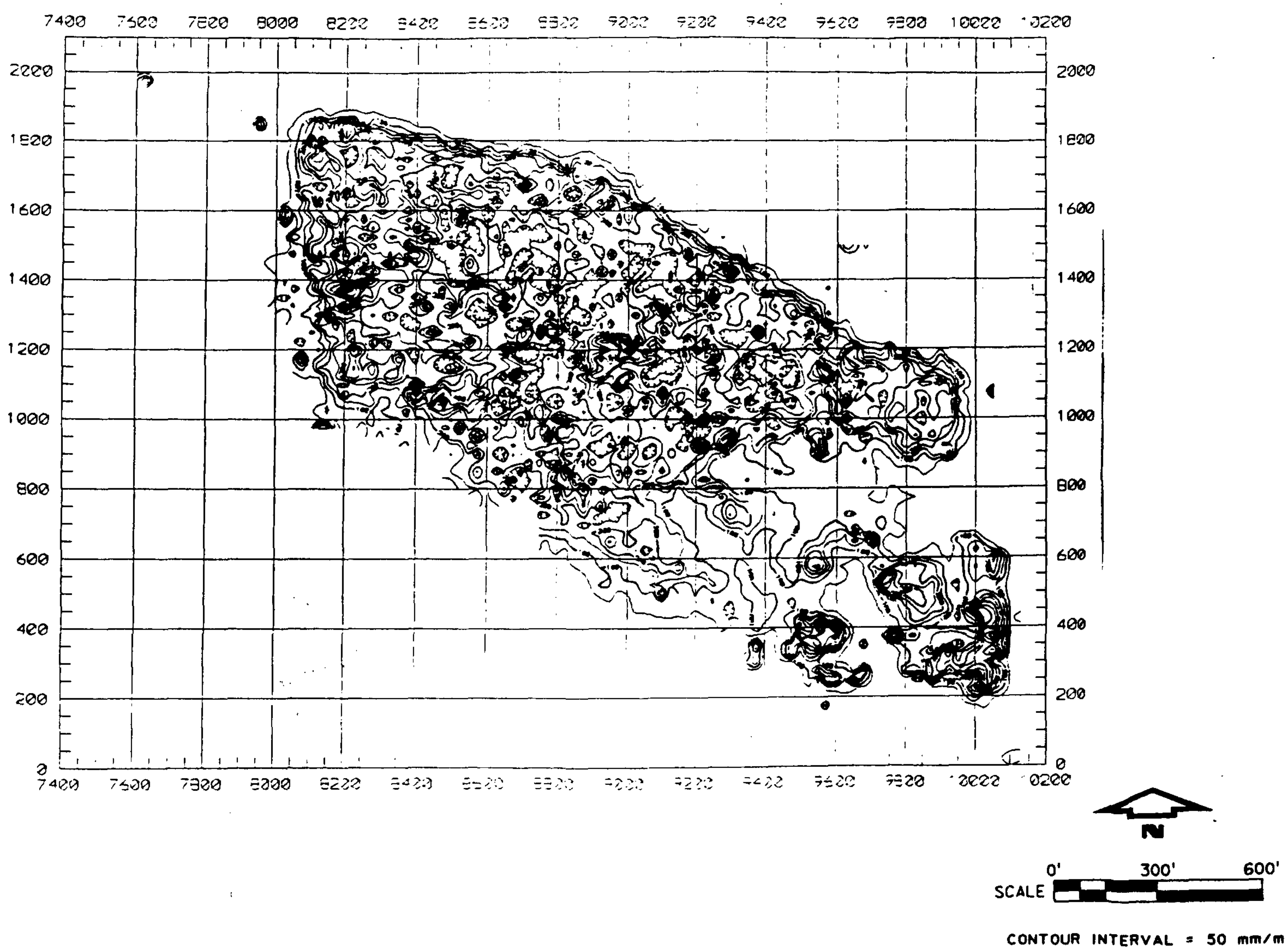


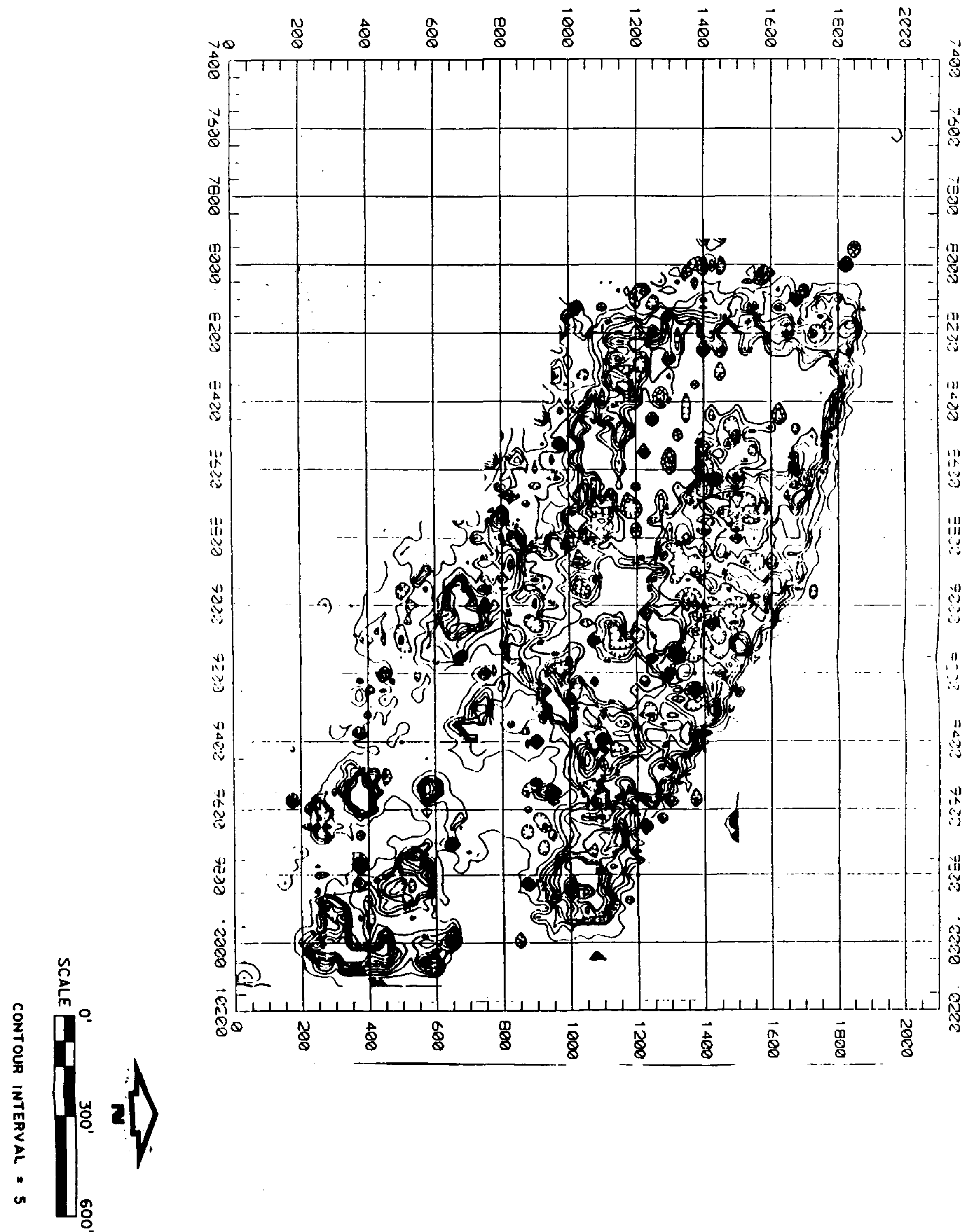
FIGURE 6
QUADRATURE PHASE EM-31 SURVEY
(TECHNICAL MEMO)

HIMCO DUMP
SUPERFUND SITE
ELKHART, INDIANA

MAY 1991

20028

Donohue ENGINEERS ARCHITECTS SCIENTISTS



MAY 1991

FIGURE 3
IN-PHASE EM-31 SURVEY
(TECHNICAL MEMO)

HIMCO DUMP
SUPERFUND SITE
ELKHART, INDIANA

20026

Donohue ENGINEERS ARCHITECTS SCIENTISTS

TECHNICAL MEMORANDUM NUMBER 11

DATE: February 13, 1991

TO: Vanessa Harris

CC: Marcia Kuehl - RI Lead
Roman Gau - Project Manager
Mike Crosser - TSQAM

FROM: Tom Puchalski

PRELIMINARY

SUBJECT: EPA ARCS Region V Contract No. 68-W8-0093
EPA Work Assignment No. 17-5L4J
Donohue Project No. 20026.024
Kimco Dump

SLUG TESTING FIELD PROCEDURES AND ANALYSIS

Introduction

Following well development, groundwater monitoring wells listed in Table 1, were slug-tested at the Himco Dump. Wells E3, F1, F2, M1, and M2 were installed in 1977 and 1979 by the U.S.G.S. The remainder of the wells were installed by Donohue for this investigation. The wells were slug-tested to determine hydraulic conductivity of the outwash deposits at several points across the site at the depths listed in Table 1. These hydraulic conductivity values will be used to evaluate the integrity of the wells and to calculate groundwater flow rates. Slug testing was done on December 1, 2, 14, and January 4, 1991, by Cathy Fruehe, Tracy Koach, Anya Kirykowicz, and Tom Puchalski of Donohue & Associates, Inc.

Field Methods

An ORS Environmental Equipment Model EL-200 data logger and pressure transducer were used to collect all of the slug test data. The battery-operated unit translates water pressure into electrical signals within the transducer. The electrical signals are relayed by a cable to the data logger where they are converted and displayed as water level data. The time and water level data are recorded during the test and stored in the data logger memory until the data is sent to a disk or printer for later analysis.

Slug tests were performed as described in Section 4.2.3.3 of the Final Field Sampling Plan, Himco Dump Remedial Investigation/Feasibility Study, Elkhart, Indiana. The setup for the slug test began by unlocking the protective casing and using a decontaminated popper tape to measure the static water level and the depth to the well bottom. This data was recorded on the slug test field data form. A 15 or 5 psi transducer was decontaminated with soap and tap water, and a tap water rinse before lowering into the well. The mode which allows the water level to be read on the data logger display was activated so that the depth of water above the transducer could be read while the transducer was lowered into the water. The transducer cable was duct taped to the

REFERENCES

Bouwer, H., The Bouwer and Rice Slug Test - An Update, v. 27, n. 3, pp. 304-309, 1989.

Bouwer, H., and Rice, R.C., A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells, Water Resources Research, v. 12, n. 3, pp. 423-428, 1976.

Freeze, R.A., and Cherry, J.A., Groundwater, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, pp. 29, 1979.

TABLE 1

WELL NUMBER	HYDRAULIC CONDUCTIVITY (cm/s)	BOTTOM DEPTH OF SCREEN	SCREENED IN
M1-RISE	3.17×10^{-3}	103.24	SP, GP
M1-FALL	1.43×10^{-3}	103.24	SP, GP
F1-RISE	1.21×10^{-1}	31.28	*
F1-FALL	4.51×10^{-2}	31.28	*
F2-FALL	1.27×10^{-3}	147.83	*
F2-RISE	7.37×10^{-4}	147.83	*
M2-RISE	3.69×10^{-2}	24.76	*
E3-RISE	7.95×10^{-4}	175.65	SP, GP
E3-FALL	4.61×10^{-4}	175.65	SP, GP
P101B-FALL	3.99×10^{-3}	100.47	SM
P101C-FALL	1.11×10^{-3}	166.53	SP
P102B-RISE	3.50×10^{-2}	67.25	SP
P102B-FALL	3.91×10^{-2}	67.25	SP
P102C-RISE	3.59×10^{-3}	159.96	SP
WT101A-RISE	2.69×10^{-2}	18.70	SP
WT101A-FALL	9.45×10^{-3}	18.70	SP
WT102A-RISE	4.14×10^{-3}	18.18	SP-SM,SP-GP,SM
WT102A-FALL	6.80×10^{-3}	18.18	SP-SM,SP-GP,SM
WT103A-RISE	4.10×10^{-2}	18.47	SW-GW
WT103A-FALL	1.86×10^{-2}	18.47	SW-GW
WT104A-RISE	3.89×10^{-2}	18.69	SP,SW-GW
WT104A-FALL	5.07×10^{-3}	18.69	SP,SW-GW
WT105A-RISE	1.93×10^{-2}	18.56	SP
WT105A-FALL	1.01×10^{-2}	18.56	SP
WT106A-RISE	4.71×10^{-2}	18.50	SP-GP
WT106A-FALL	8.40×10^{-2}	18.50	SP-GP

* Data not available.

A/R/HIMCO/AB6

APPENDIX A

DATA PLOTS AND ANALYSIS

BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
TO UTILIZE THIS WORKSHEET, ENTER YOUR DATA AT LOCATIONS MARKED BY AN "#".
PROGRAM CAN INCLUDE EFFECTS OF SANDPACK DEWATERING (ASSUMING WATER IS RISING WITHIN THE SANDPACK).

#	TIME min. (T)	DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (t)	LN (Y)
1		8.42	1.560	0.00	0.4447
2		8.44	1.540	0.20	0.4318
3		8.46	1.520	0.40	0.4187
4		8.49	1.490	0.60	0.3988
5		8.50	1.480	0.80	0.3920
6		8.52	1.460	1.00	0.3784
7		8.54	1.440	1.20	0.3646
8		8.55	1.430	1.40	0.3577
9		8.57	1.410	1.60	0.3436
10		8.59	1.390	1.80	0.3293
11		8.61	1.370	2.00	0.3148
12		8.62	1.360	2.20	0.3075
13		8.64	1.340	2.40	0.2927
14		8.65	1.330	2.60	0.2852
15		8.67	1.310	2.80	0.2700
16		8.68	1.300	3.00	0.2624
17		8.70	1.280	3.20	0.2469
18		8.72	1.260	3.40	0.2311
19		8.74	1.240	3.60	0.2151
20		8.75	1.230	3.80	0.2070
21		8.76	1.220	4.00	0.1989
22		8.78	1.200	4.20	0.1823
23		8.79	1.190	4.40	0.1740
24		8.81	1.170	4.60	0.1570
25		8.83	1.150	5.00	0.1398
26		8.84	1.140	5.20	0.1310
27		8.86	1.120	5.40	0.1133
28		8.88	1.100	5.60	0.0953
29		8.89	1.090	6.00	0.0862
30		8.91	1.070	6.20	0.0677
31		8.92	1.060	6.40	0.0583
32		8.94	1.040	6.60	0.0392
33		8.95	1.030	7.00	0.0296
34		8.98	1.000	8.00	0.0000
35		9.03	0.950	9.00	-0.0513
36		9.08	0.900	10.00	-0.1054
37		9.13	0.850	11.00	-0.1625
38		9.19	0.790	12.00	-0.2357
39		9.23	0.750	13.00	-0.2877
40		9.27	0.710	14.00	-0.3425
41		9.32	0.660	15.00	-0.4155
42		9.35	0.630	16.00	-0.4620
43		9.39	0.590	17.00	-0.5276
44		9.43	0.550	18.00	-0.5978
45		9.46	0.520	19.00	-0.6539
46		9.49	0.490	20.00	-0.7133
47		9.52	0.460	21.00	-0.7765
48		9.55	0.430	22.00	-0.8440
49		9.58	0.400	23.00	-0.9163
50		9.62	0.360	25.00	-1.0217
51		9.66	0.320	27.00	-1.1394
52		9.71	0.270	29.00	-1.3093
53		9.74	0.240	31.00	-1.4271
54		9.77	0.210	33.00	-1.5606
55		9.79	0.190	35.00	-1.6607
56		9.82	0.160	37.00	-1.8326
57		9.84	0.140	39.00	-1.9661
58		9.86	0.120	41.00	-2.1203
59		9.87	0.110	43.00	-2.2073
60		9.89	0.090	45.00	-2.4079
61		9.9[illegible]	0.080	47.00	-2.5257
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]

#PROJECT NAME :HIMCO
#PROJECT NO : 20036.024
#WELL NO :M-1 RISE
#ANALYST : :PUCHALSKI
#DATE COLLECTED :12-2-90
#RISER PIPE (ID): (2 r sub c) = 2.0 in. = 0.0833 (radius in ft.)
#EFFECTIVE SCREEN DIAMETER:(2 r sub w) = 8.0 in. = 0.3333 (radius in ft.)
#EFFECTIVE SCREEN LENGTH: (L) = 5.00 Ft.
#MAX DRAWDOWN (IN SUBSET): (Ymax) = 1.56 Ft.
#STATIC WATER LEVEL: (SWL) = 9.98 Ft.
#DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 58.40 Ft.
#EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 175.00 Ft.
#INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 0
#SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 15.00
---LOG OF L/(r sub w) = 1.1761
FOR PARTIALLY PENETRATING WELLS--
A = 1.93
B = 0.29
FOR FULLY PENETRATING WELLS--
C = 1.38

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.1971
CONST.2 = 5.5599 =(MAX. OF 6.0)= 5.5599
LN(Re/(r sub w)) = 2.30

EFFECTIVE r sub c (for sandpack dewatering) = 0.0833
(1/T)(LN(Yo/Yt)) (SLOPE) = -6.50E-02 sec^(-1)

HYDRAULIC CONDUCTIVITY (K) = 1.04E-04 ft/sec (==================
3.17E-03 cm/sec (==================

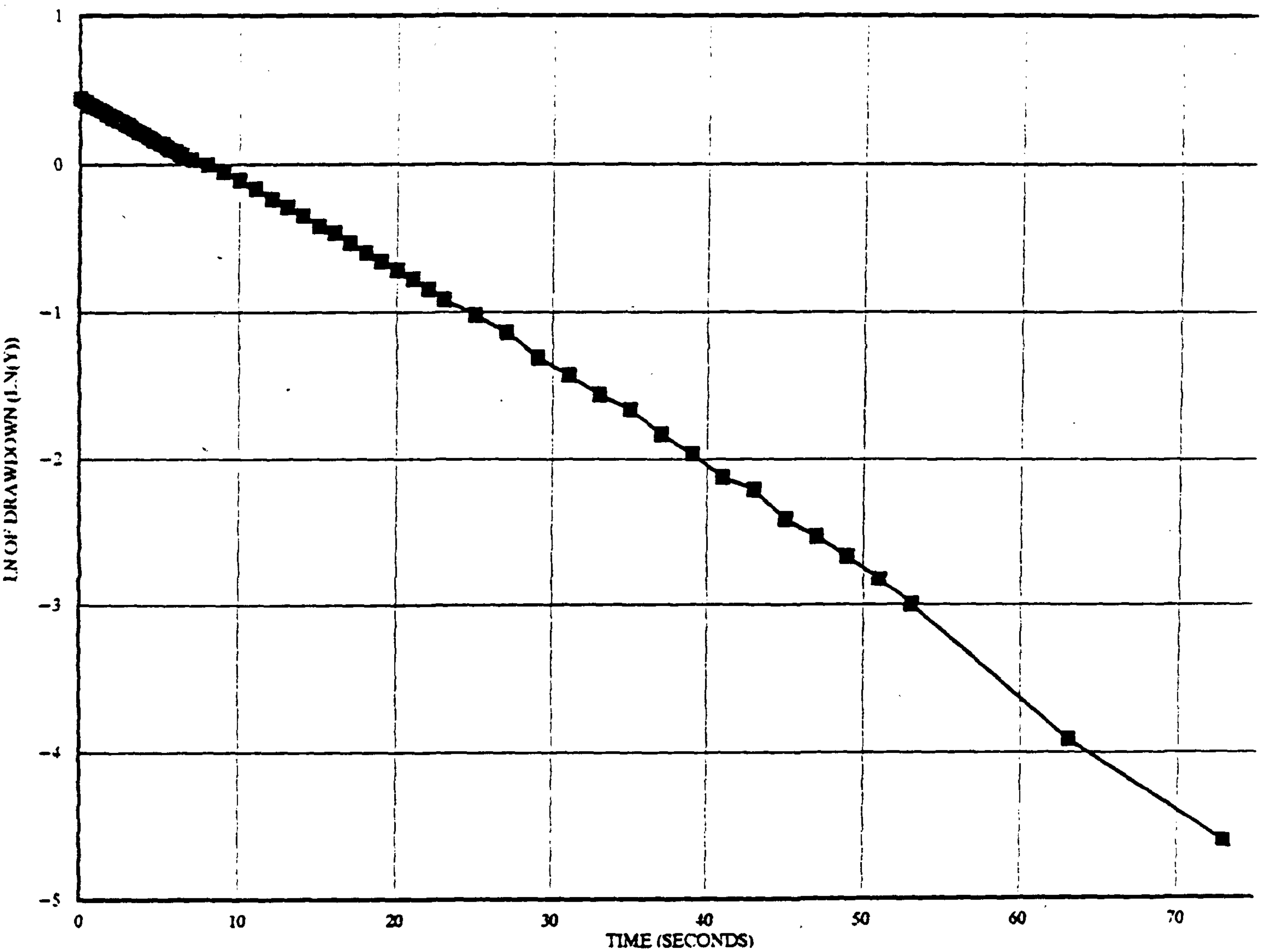
t= 0 - 73 s

Regression Output:

Constant	4.96E-01
Std Err of Y Est	0.0842
R Squared	0.9947
No. of Observations	66
Degrees of Freedom	64
X Coefficient(s)	-6.50E-02
Std Err of Coef.	0.0006

RATE OF RECOVERY TEST: WELL M-1

RISE



BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.

TO UTILIZE THIS WORKSHEET, ENTER YOUR DATA AT LOCATIONS MARKED BY AN "#".

PROGRAM CAN INCLUDE EFFECTS OF SANDPACK DEWATERING (ASSUMING WATER IS RISING WITHIN THE SANDPACK).

#	#TIME min (t)	#DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (T)	LN (Y)
1		11.36	1.380	0.00	0.3221
2		11.34	1.360	0.20	0.3075
3		11.33	1.350	0.40	0.3001
4		11.32	1.340	0.60	0.2927
5		11.31	1.330	0.80	0.2852
6		11.30	1.320	1.20	0.2776
7		11.29	1.310	1.40	0.2700
8		11.28	1.300	1.60	0.2624
9		11.27	1.290	1.80	0.2546
10		11.25	1.270	2.20	0.2390
11		11.24	1.260	2.40	0.2311
12		11.23	1.250	2.60	0.2231
13		11.22	1.240	2.80	0.2151
14		11.21	1.230	3.00	0.2070
15		11.20	1.220	3.20	0.1989
16		11.19	1.210	3.40	0.1906
17		11.18	1.200	3.60	0.1823
18		11.17	1.190	4.00	0.1740
19		11.16	1.180	4.20	0.1655
20		11.15	1.170	4.40	0.1570
21		11.14	1.160	4.60	0.1484
22		11.13	1.150	4.80	0.1398
23		11.12	1.140	5.00	0.1310
24		11.11	1.130	5.40	0.1222
25		11.09	1.110	6.40	0.1044
26		11.05	1.070	7.40	0.0677
27		11.02	1.040	8.40	0.0392
28		10.99	1.010	9.40	0.0100
29		10.94	0.960	10.40	-0.0408
30		10.92	0.940	11.40	-0.0619
31		10.88	0.900	12.40	-0.1054
32		10.85	0.870	13.40	-0.1393
33		10.82	0.840	14.40	-0.1744
34		10.79	0.810	15.40	-0.2107
35		10.76	0.780	16.40	-0.2485
36		10.73	0.750	17.40	-0.2877
37		10.71	0.730	18.40	-0.3147
38		10.68	0.700	19.40	-0.3567
39		10.66	0.680	20.40	-0.3857
40		10.64	0.660	21.40	-0.4155
41		10.54	0.560	26.40	-0.5798
42		10.44	0.460	31.40	-0.7765
43		10.37	0.390	36.40	-0.9416
44		10.31	0.330	41.40	-1.1087
45		10.26	0.280	46.40	-1.2730
46		10.22	0.240	51.40	-1.4271
47		10.18	0.200	56.40	-1.6094
48		10.16	0.180	61.40	-1.7148
49		10.13	0.150	66.40	-1.8971
50		10.10	0.120	71.40	-2.1203
51		10.09	0.110	76.40	-2.2073
52		10.07	0.090	81.40	-2.4079
53		10.06	0.080	86.40	-2.5257
54		10.05	0.070	91.40	-2.6593
55		10.03	0.050	96.40	-2.9957
56		10.01	0.030	126.40	-3.5066
57		10.00	0.020	156.40	-3.9120
58		9.99	0.010	186.40	-4.6052

#PROJECT NAME : MINCO
#PROJECT NO : 20026.024
#WELL NO : MW-1 FALL
#ANALYST : PUCHALSKI
#DATE COLLECTED : 12-3-90
#RISER PIPE (ID): (2 r sub c) = 2.0 in. = 0.0833 (radius in Ft.)
#EFFECTIVE SCREEN DIAMETER: (2 r sub w) = 5.0 in. = 0.2083 (radius in Ft.)
#EFFECTIVE SCREEN LENGTH: (L) = 5.00 Ft.
#MAX DRAWDOWN (IN SUBSET): (Ymax) = -1.38 Ft.
#STATIC WATER LEVEL: (SWL) = 9.98 Ft.
#DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 99.40 Ft.
#EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 175.00 Ft.
#INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 0
#SANDPACK % SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 15.00
---LOG OF L/(r sub w) = 1.1761
FOR PARTIALLY PENETRATING WELLS--
A = 1.93
B = 0.29
FOR FULLY PENETRATING WELLS-- -
C = 1.38

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.1971
CONST.2 = 5.5599 =(MAX. OF 6.0)= 5.5599
LN(Re/(r sub w)) = 2.30

EFFECTIVE r sub c (for sandpack dewatering) = 0.0833
(1/T)(LN(Yo/Yt)) (SLOPE) = -2.94E-02 sec^(-1)

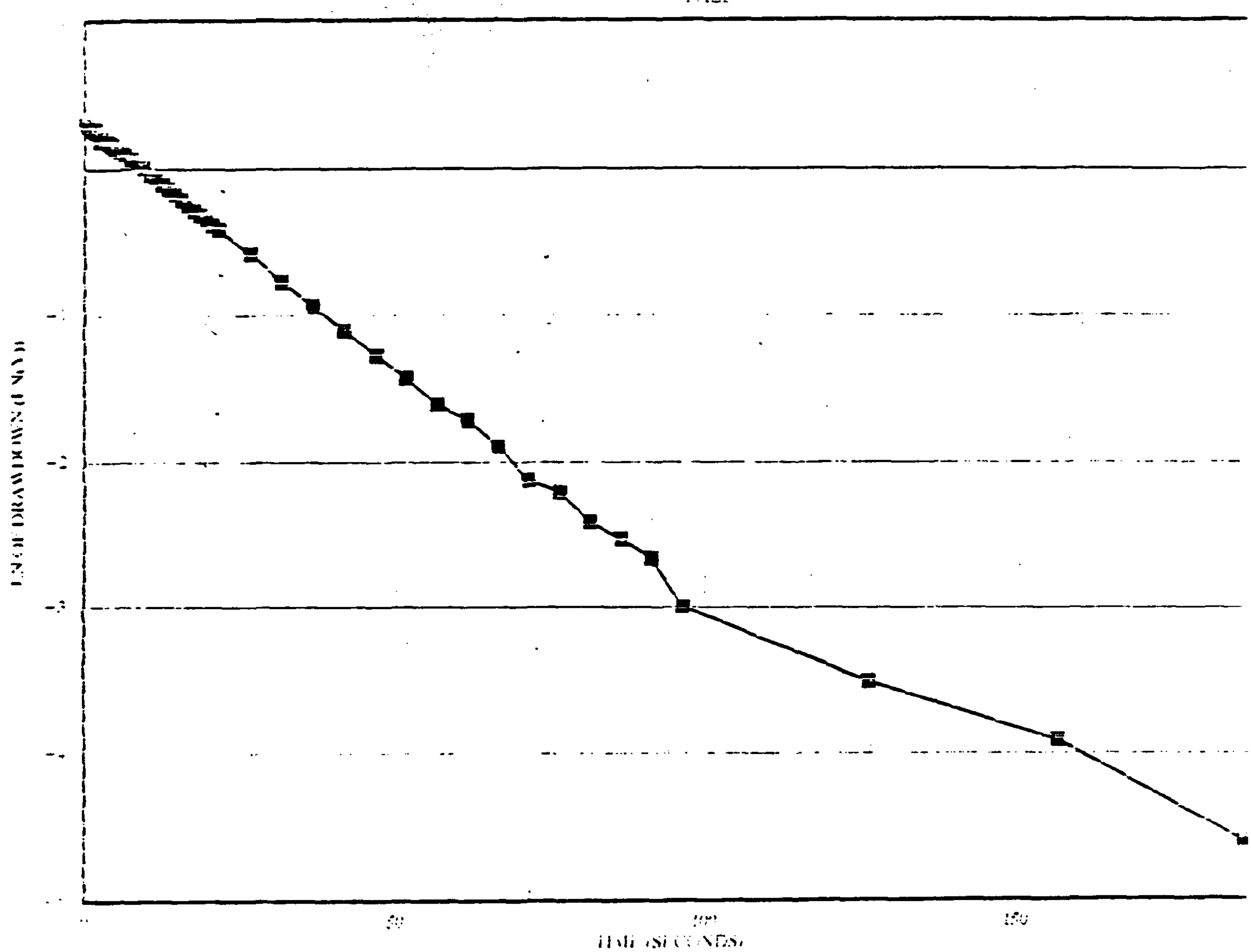
HYDRAULIC CONDUCTIVITY (K) = 4.70E-05 ft/sec (==================
1.43E-03 cm/sec (==================

$t = 0 - 186.4$ s

Regression Output:

Constant		2.37E-01
Std Err of Y Est		0.1530
R Squared		0.9841
No. of Observations		58
Degrees of Freedom		56
X Coefficient(s)	-2.94E-02	
Std Err of Coef.	0.0005	

RATE OF RECOVERY TEST: WELL M-1



BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
TO UTILIZE THIS WORKSHEET, ENTER YOUR DATA AT LOCATIONS MARKED BY AN "#".
PROGRAM CAN INCLUDE EFFECTS OF SANDPACK DEWATERING (ASSUMING WATER IS RISING WITHIN THE SANDPACK).

#	#TIME min (T)	#DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (T)	LN (Y)
1		11.78	1.730	0.00	0.5481
2		11.41	1.360	0.20	0.3075
3		10.73	0.680	1.00	-0.3857
4		10.54	0.490	1.40	-0.7133
5		10.44	0.390	1.60	-0.9416
6		10.38	0.330	1.80	-1.1087
7		10.30	0.250	2.00	-1.3863
8		10.23	0.180	2.20	-1.7148
9		10.16	0.110	2.40	-2.2073
10		10.15	0.100	2.60	-2.3026
11		10.09	0.040	2.80	-3.2189
12		10.07	0.020	3.00	-3.9120
13		10.06	0.010	8.00	-4.6052
14		10.05	0.000	10.00	ERR

#PROJECT NAME :HIMCO
#PROJECT NO : 2092a.024
#WELL NO :PH- FALL
#ANALYST :PUCHALSKI
#DATE COLLECTED :12-2-94
#RISER PIPE (ID): (r sub c) = 2.0 in. = 0.0833 (radius in ft.)
#EFFECTIVE SCREEN DIAMETER: (r sub w) = 6.0 in. = 0.2500 (radius in ft.)
#EFFECTIVE SCREEN LENGTH: (L) = 5.00 Ft.
#MAX DRAWDOWN (IN SUBSET): (Ymax) = -1.70 Ft.
#STATIC WATER LEVEL: (SWL) = 10.05 Ft.
#DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 22.55 Ft.
#EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 175.00 Ft.
#INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 0
#SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 15.00
---LOG OF L/(r sub w) = 1.1761
FOR PARTIALLY PENETRATING WELLS---
A = 1.93
B = 0.29
FOR FULLY PENETRATING WELLS---
C = 1.38

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.2602
CONST.2 = 6.1225 *(MAX. OF 6.0)= 6.0000
LN(Re/(r sub w)) = 1.98

EFFECTIVE r sub c (for sandpack dewatering) = 0.0833
(1/T)(LN(Yo/Yt)) (SLOPE) = -1.08E+00 sec^(-1)

HYDRAULIC CONDUCTIVITY (K) = 1.48E-03 ft/sec
4.51E-02 cm/sec

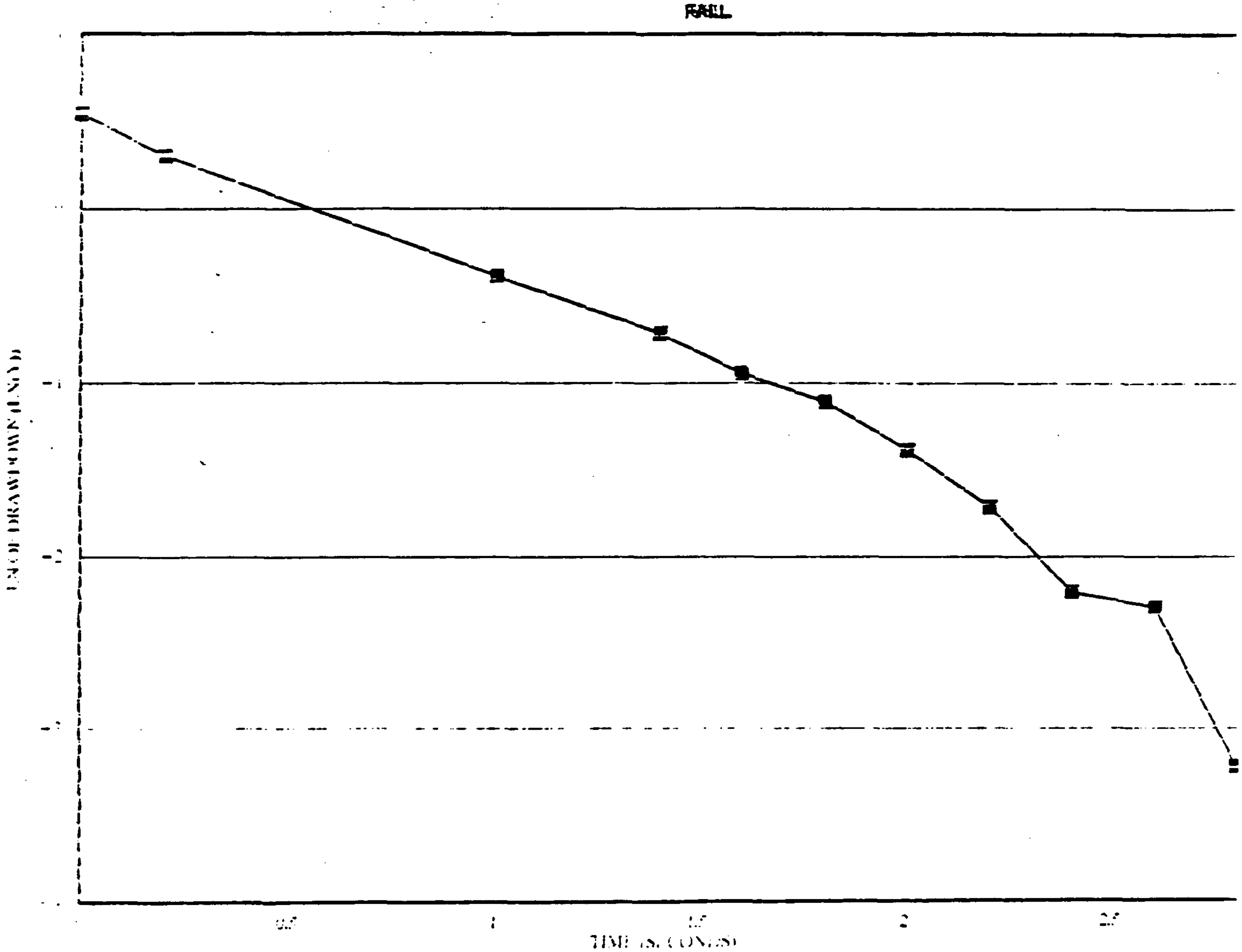
t = 0-2.6 s

Regression Output:

Constant	6.47E-01
Std Err of Y Est	0.1620
R Squared	0.9750
No. of Observations	10
Degrees of Freedom	8
X Coefficient(s)	-1.08E+00
Std Err of Coef.	0.0610

RATE OF RECOVERY TEST: WELL F–1.

FALL



BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
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#	*TIME min (T)	*DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (T)	LN (Y)
1		9.61	0.440	0.00	-0.8210
2		9.73	0.320	0.20	-1.1394
3		9.97	0.080	0.80	-2.5257
4		10.03	0.020	1.00	-3.9120
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43					

*PROJECT NAME : HIMCO
*PROJECT NO : [illegible]
*WELL NO : P-1 RISE
*ANALYST : [illegible]
*DATE COLLECTED : 12-3-90
*RISER PIPE (D): (2 r sub c) = 2.0 in. = 0.0833 (radius in ft.)
*EFFECTIVE SCREEN DIAMETER: (2 r sub w) = 8.0 in. = 0.3333 (radius in ft.)
*EFFECTIVE SCREEN LENGTH: (L) = 5.00 Ft.
*MAX DRAWDOWN (IN SUBSET): (Ymax) = -1.31 Ft.
*STATIC WATER LEVEL: (SWL) = 10.05 Ft.
*DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 22.85 Ft.
*EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 175.00 Ft.
*INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 0
*SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 15.00
---LOG OF L/(r sub w) = 1.1761
FOR PARTIALLY PENETRATING WELLS---
A = 1.93
B = 0.29
FOR FULLY PENETRATING WELLS---
C = 1.28

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.2602
CONST.2 = 6.1235 =(MAX. OF 6.0)= 6.0000
LN(Re/(r sub w)) = 1.98

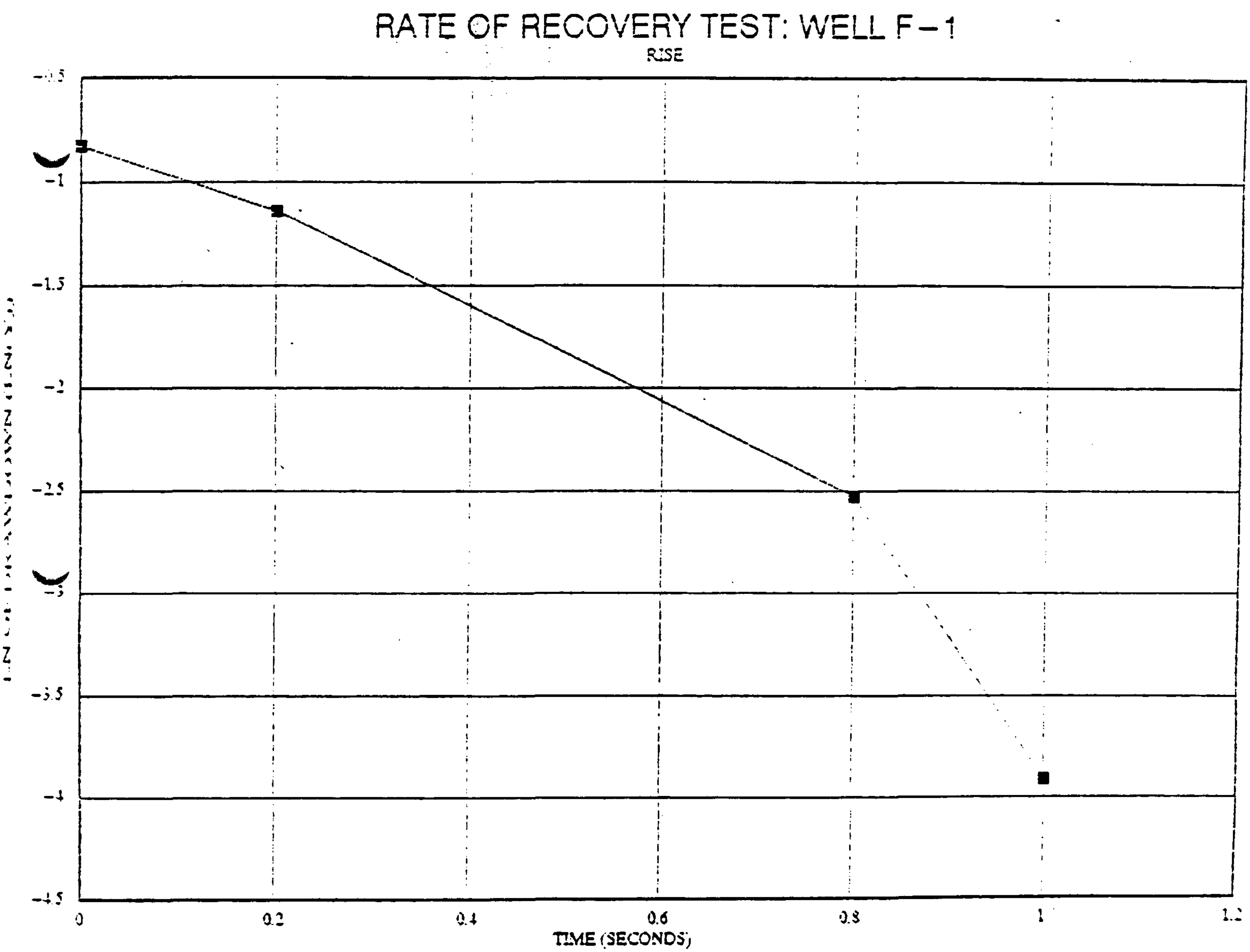
EFFECTIVE r sub c (for sandpack dewatering) = 0.0833
(1/T)(LN(Yo/Yt)) (SLOPE) = -2.99E+00 sec^(-1)

HYDRAULIC CONDUCTIVITY (K) = 3.96E-03 ft/sec (=================
1.21E-01 cm/sec (=================

t = 0-1 s

Regression Output:

Constant		-6.57E-01
Std Err of Y Est		0.4276
R Squared		0.9293
No. of Observations		4
Degrees of Freedom		2
X Coefficient(s)	-2.99E+00	
Std Err of Coef.	0.5186	



RATE OF RECOVERY TEST: WELL F-1
RISE
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
0
0.2
0.4
0.6
0.8
1
1.2
TIME (SECONDS)

BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
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#	#TIME min. (I)	#DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (X)	LN (Y)
1		9.80	0.260	0.00	-1.3471
2		9.81	0.250	1.00	-1.3863
3		9.82	0.240	4.00	-1.4271
4		9.83	0.230	6.00	-1.4697
5		9.84	0.220	9.00	-1.5141
6		9.85	0.210	14.00	-1.5606
7		9.86	0.200	17.00	-1.6094
8		9.87	0.190	20.00	-1.6607
9		9.89	0.170	27.00	-1.7720
10		9.90	0.160	32.00	-1.8326
11		9.91	0.150	42.00	-1.8971
12		9.93	0.130	47.00	-2.0402
13		9.94	0.120	57.00	-2.1203
14		9.95	0.110	62.00	-2.2073
15		9.96	0.100	67.00	-2.3026
16		9.97	0.090	82.00	-2.4079
17		9.98	0.080	87.00	-2.5257
18		10.01	0.050	127.00	-2.9957
19		10.03	0.030	157.00	-3.5066
20		10.04	0.020	247.00	-3.9120
21		10.05	0.010	427.00	-4.6052
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#PROJECT NAME :MIMCO
#PROJECT NO. : 20026.024
#WELL NO :P-2 RISE
#ANALYST :PUCHALSKI
#DATE COLLECTED :12-2-90
#RISER PIPE (ID): (2 r sub c) = 2.0 in. = 0.0833 (radius in Ft.)
#EFFECTIVE SCREEN DIAMETER: (2 r sub w) = 8.0 in. = 0.3333 (radius in Ft.)
#EFFECTIVE SCREEN LENGTH: (L) = 5.00 Ft.
#MAX DRAWDOWN (IN SUBSET): (Ymax) = 0.26 Ft.
#STATIC WATER LEVEL: (SWL) = 10.06 Ft.
#DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 166.25 Ft.
#EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 175.00 Ft.
#INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 0
#SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 15.00
---LOG OF L/(r sub w) = 1.1761
FOR PARTIALLY PENETRATING WELLS--
A = 1.93
B = 0.29
FOR FULLY PENETRATING WELLS--
C = 1.38

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.1771
CONST.2 = 3.2677 =(MAX. OF 6.0)= 3.2677
LN(Re/(r sub w)) = 2.71

EFFECTIVE r sub c (for sandpack dewatering) = 0.0833
(1/T)(LN(Yo/Yt)) (SLOPE) = -1.29E-02 sec^(-1)

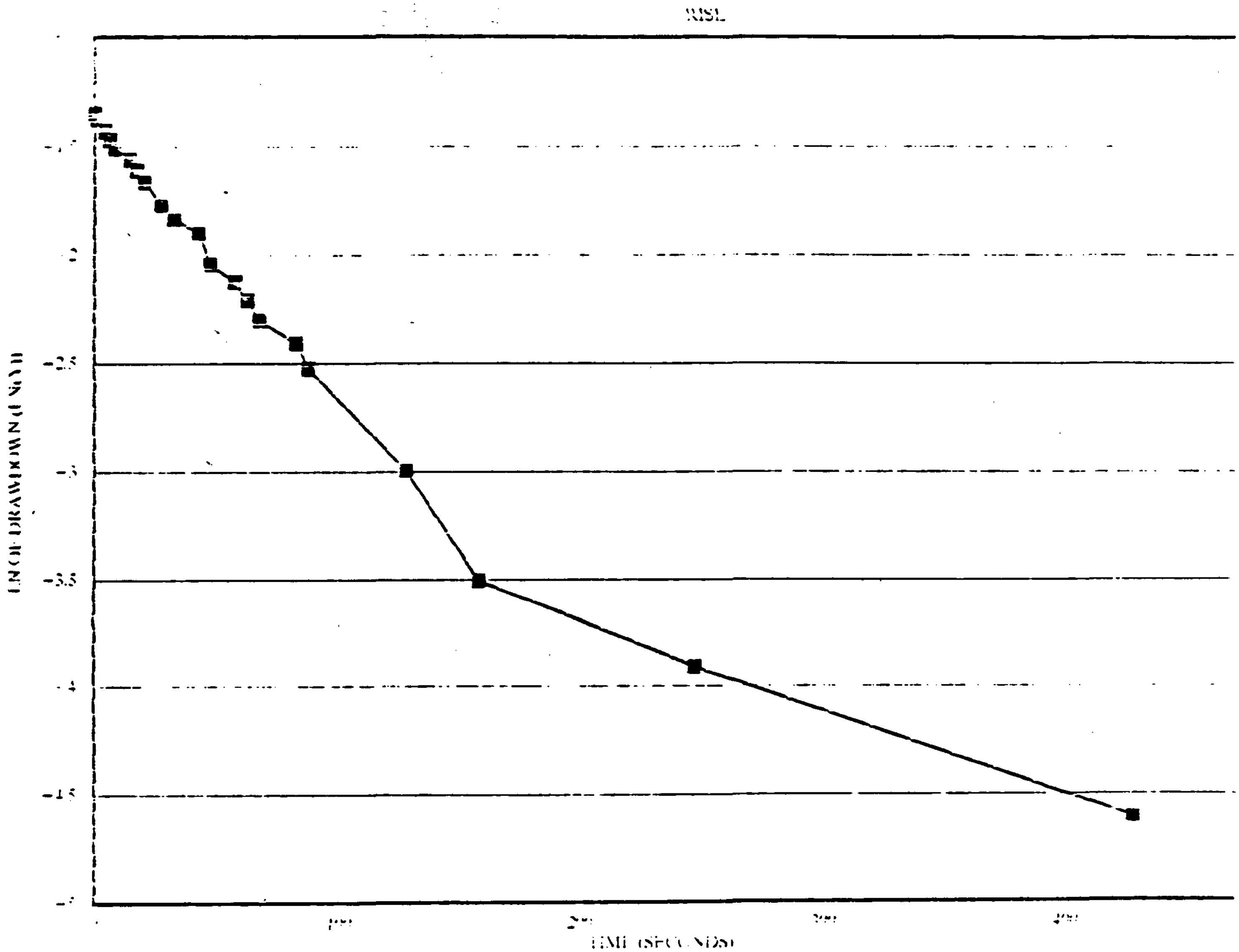
HYDRAULIC CONDUCTIVITY (K) = 2.42E-05 ft/sec <==============
7.37E-04 cm/sec <==============

t= 0-1275

Regression Output:

Constant	-1.39E+00
Std Err of Y Est	0.0292
R Squared	0.9962
No. of Observations	18
Degrees of Freedom	16
X Coefficient(s)	-1.29E-02
Std Err of Coef.	0.0002

RATE OF RECOVERY TEST: WELL F-2



BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
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#	#TIME min. (T)	#DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (X)	LN (Y)
1		6.03	0.980	0.00	-0.02
2		6.28	0.730	0.40	-0.31
3		6.32	0.690	1.20	-0.37
4		6.36	0.650	1.40	-0.43
5		6.39	0.620	1.60	-0.48
6		6.42	0.590	1.80	-0.53
7		6.45	0.560	2.00	-0.58
8		6.48	0.530	2.20	-0.63
9		6.50	0.510	2.40	-0.67
10		6.52	0.490	2.60	-0.71
11		6.54	0.470	2.80	-0.76
12		6.57	0.440	3.00	-0.82
13		6.58	0.430	3.20	-0.84
14		6.60	0.410	3.40	-0.89
15		6.62	0.390	3.60	-0.94
16		6.63	0.380	3.80	-0.97
17		6.64	0.370	4.00	-0.99
18		6.66	0.350	4.20	-1.05
19		6.68	0.330	4.40	-1.11
20		6.70	0.310	4.60	-1.17
21		6.71	0.300	5.00	-1.20
22		6.72	0.290	5.20	-1.24
23		6.73	0.280	5.40	-1.27
24		6.75	0.260	5.60	-1.35
25		6.76	0.250	6.00	-1.39
26		6.77	0.240	6.20	-1.43
27		6.78	0.230	6.40	-1.47
28		6.79	0.220	6.60	-1.51
29		6.80	0.210	6.80	-1.56
30		6.81	0.200	7.00	-1.61
31		6.82	0.190	7.60	-1.66
32		6.83	0.180	8.00	-1.71
33		6.84	0.170	8.40	-1.77
34		6.85	0.160	8.60	-1.83
35		6.86	0.150	9.00	-1.90
36		6.87	0.140	9.40	-1.97
37		6.88	0.130	9.80	-2.04
38		6.89	0.120	11.30	-2.12
39		6.91	0.100	12.00	-2.30
40		6.92	0.090	12.80	-2.41
41		6.94	0.070	14.80	-2.66
42		6.95	0.060	15.80	-2.81
43		6.96	0.050	18.30	-3.00
44		6.97	0.040	20.30	-3.22
45		6.98	0.030	22.60	-3.51
46		6.99	0.020	27.60	-3.91
47		7.00	0.010	33.60	-4.61

#PROJECT NAME :HIMCO
#PROJECT NO: 20026.024
#WELL NO :MW-1 RISE
#ANALYST :FUCHALSKI
#DATE COLLECTED :12-2-90
#RISER PIPE (ID): (2 r sub c) = 2.0 in. = 0.0833 (radius in ft.)
#EFFECTIVE SCREEN DIAMETER: (2 r sub w) = 8.0 in. = 0.3333 (radius in ft.)
#EFFECTIVE SCREEN LENGTH: (L) = 5.00 Ft.
#MAX DRAWDOWN (IN SUBSET): (Ymax) = 0.98 Ft.
#STATIC WATER LEVEL: (SWL) = 7.01 Ft.
#DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 9.53 Ft.
#EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 175.00 Ft.
#INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 0
#SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 15.00
---LOG OF L/(r sub w) = 1.1761
FOR PARTIALLY PENETRATING WELLS--
A = 1.93
B = 0.29
FOR FULLY PENETRATING WELLS--
C = 1.38

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.3281
CONST.2 = 6.2074 =(MAX. OF 6.0)= 6.0000
LN(Re/(r sub w)) = 1.74

EFFECTIVE r sub c (for sandpack dewatering) = 0.0833
(1/T)(LN(Yo/Yt)) (SLOPE) = 1.00E+00 sec^(-1)

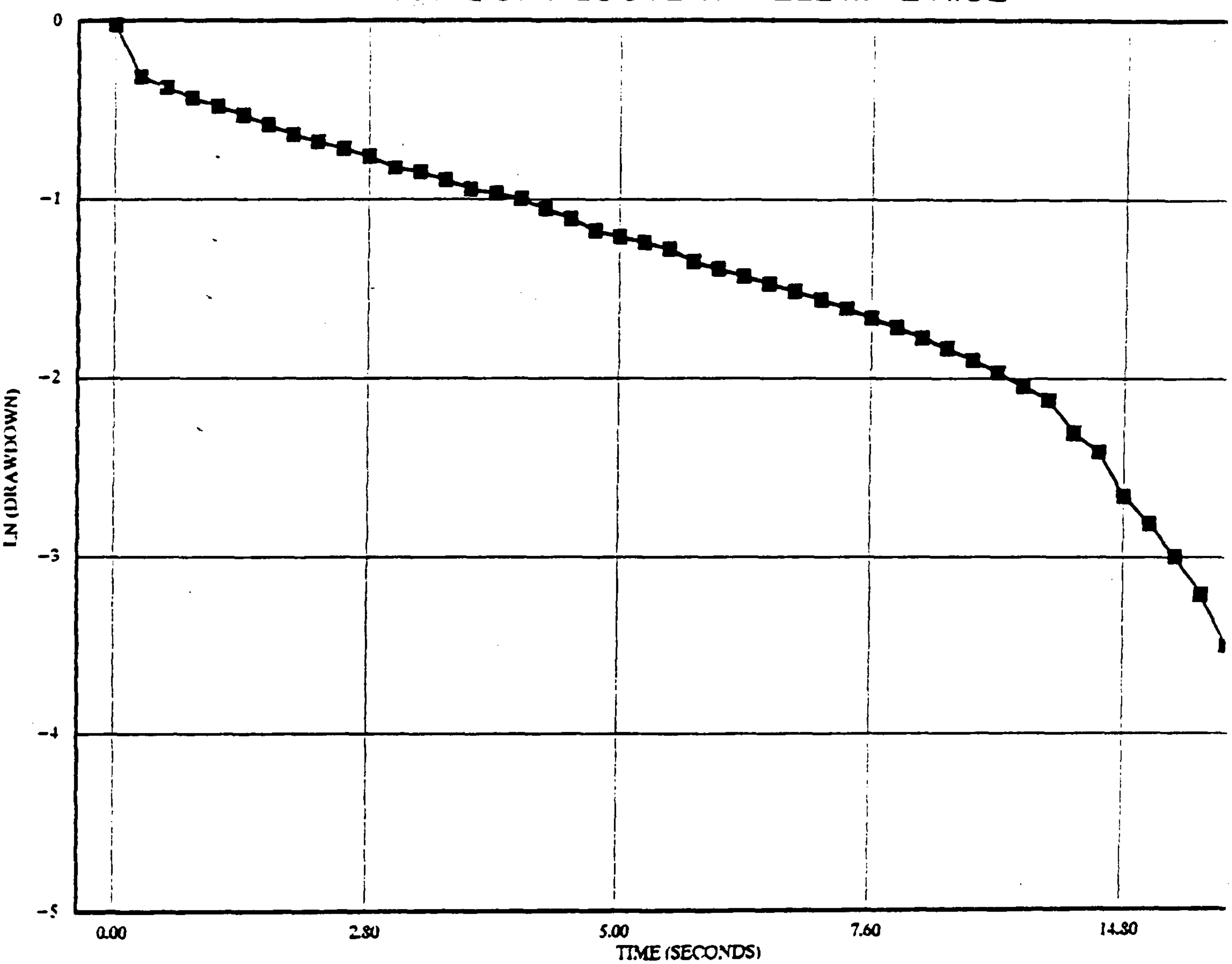
HYDRAULIC CONDUCTIVITY (K) = 1.21E-03 ft/sec <==============
3.69E-02 cm/sec <==============

t=0.4-9.85

Regression Output:

Constant		-1.73E-18
Std Err of Y Est		0.0000
R Squared		1.0000
No. of Observations		36
Degrees of Freedom		34
X Coefficient(s)	1.00E+00	
Std Err of Coef.	0.0000	

RATE OF RECOVERY WELL M-2 RISE



BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
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PROGRAM CAN INCLUDE EFFECTS OF SANDPACK DEWATERING (ASSUMING WATER IS RISING WITHIN THE SANDPACK).

!	!TIME min	!DEPTH TO WATER Ft.	DRAWDOWN (Y)	!TIME sec (T)	LN (Y)
1		8.15	0.180	0.00	-1.7148
2		8.14	0.170	2.00	-1.7720
3		8.13	0.160	6.00	-1.8326
4		8.12	0.150	9.00	-1.8971
5		8.11	0.140	11.00	-1.9661
6		8.10	0.130	19.00	-2.0402
7		8.09	0.120	23.00	-2.1203
8		8.08	0.110	27.00	-2.2073
9		8.07	0.100	31.00	-2.3026
10		8.06	0.090	35.00	-2.4079
11		8.05	0.080	41.00	-2.5257
12		8.04	0.070	53.00	-2.6593
13		8.03	0.060	63.00	-2.8134
14		8.02	0.050	73.00	-2.9957
15		8.01	0.040	83.00	-3.2189
16		8.00	0.030	93.00	-3.5066
17		7.99	0.020	103.00	-3.9120
18		7.98	0.010	123.00	-4.6052
19		7.97	0.000	183.00	ERR
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!PROJECT NAME : WIMCO
!PROJECT NO. : 2002a.024
!WELL NO : SEMI FALL
!ANALYST : ELIAS
!DATE COLLECTED : [illegible]
!RISER PIPE ID : (2 * sub c) = 2.0 in. = 0.0833 (radius in ft.)
!EFFECTIVE SCREEN DIAMETER: (2 * sub w) = 8.0 in. = 0.3333 (radius in ft.)
!EFFECTIVE SCREEN LENGTH: (L) = 11.60 Ft.
!MAX DRAWDOWN (IN SUBSET): (Ymax) = -0.18 Ft.
!STATIC WATER LEVEL: (SWL) = 7.97 Ft.
!DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 11.60 Ft.
!EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 175.00 Ft.
!INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 0
!SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 34.80
---LOG OF L/(r sub w) = 3.5496
FOR PARTIALLY PENETRATING WELLS---
A = 2.60
B = 0.36
FOR FULLY PENETRATING WELLS---
C = 2.03

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.3099
CONST.2 = 6.1948 *(MAX. OF 6.0)= 6.0000
LN(Re/(r sub w)) = 2.24

EFFECTIVE r sub c (for sandpack dewatering) = 0.0833
(1/T)(LN(Yo/Yt)) (SLOPE) = -2.23E-02 sec^(-1)

HYDRAULIC CONDUCTIVITY (K) = 1.51E-05 ft/sec <==================
4.61E-04 cm/sec <==================

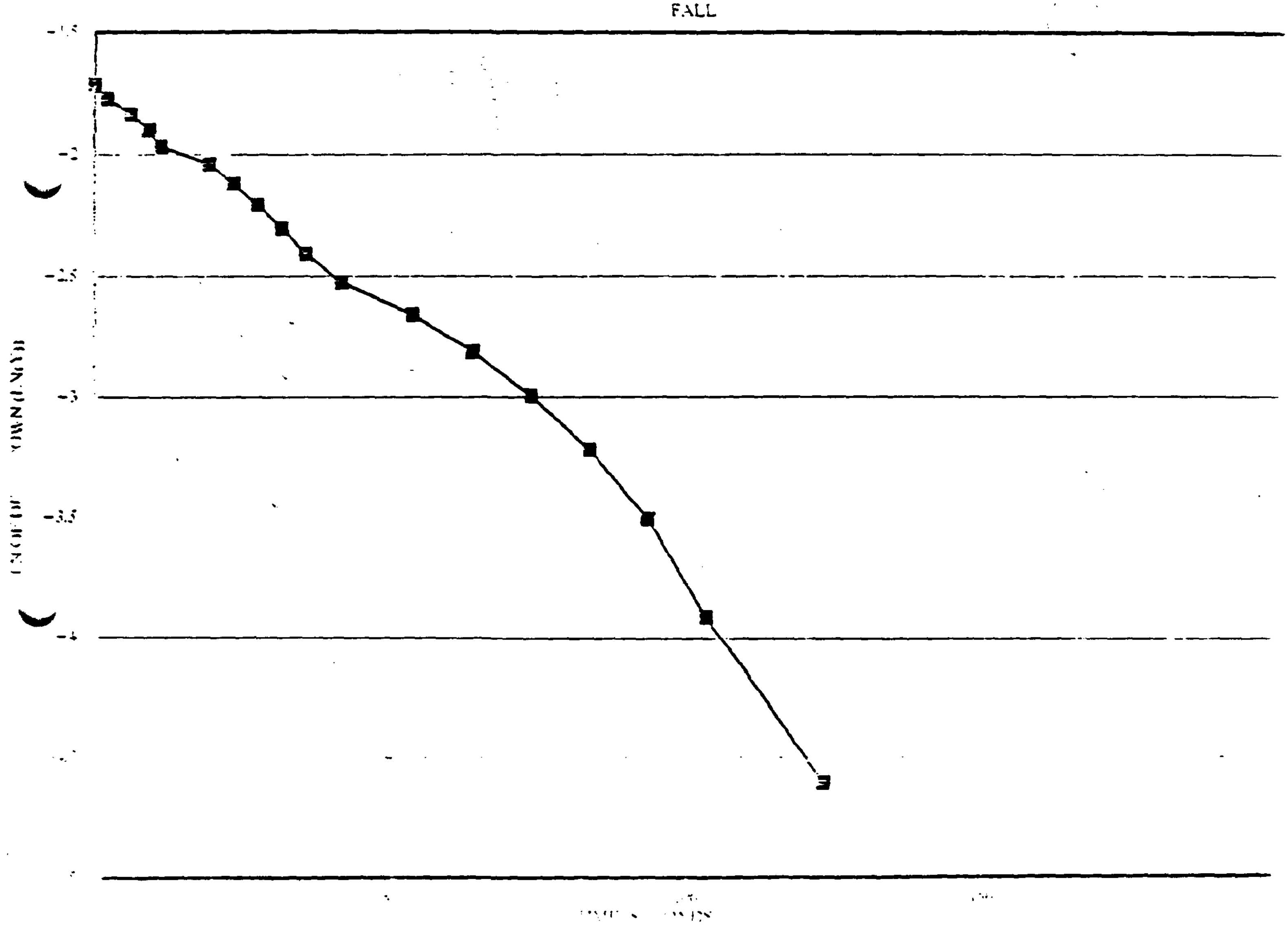
t=19-41 s

Regression Output:

Constant	-1.61E+00
Std Err of Y Est	0.0087
R Squared	0.9982
No. of Observations	6
Degrees of Freedom	4
X Coefficient(s)	-2.23E-02
Std Err of Coef.	0.0005

RATE OF RECOVERY TEST: WELL E-3

FALL



BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
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PROGRAM CAN INCLUDE EFFECTS OF SANDPACK DEWATERING (ASSUMING WATER IS RISING WITHIN THE SANDPACK).

#	TIME min (X)	DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (T)	LN (Y)
1		7.96	0.010	0.00	-4.6052
2		7.68	0.290	1.00	-1.2379
3		7.69	0.280	2.80	-1.2730
4		7.70	0.270	3.00	-1.3093
5		7.71	0.260	4.90	-1.3471
6		7.72	0.250	5.00	-1.3863
7		7.73	0.240	11.00	-1.4271
8		7.74	0.230	13.00	-1.4697
9		7.75	0.220	15.00	-1.5141
10		7.76	0.210	17.00	-1.5606
11		7.77	0.200	20.00	-1.6094
12		7.78	0.190	22.00	-1.6607
13		7.79	0.180	25.00	-1.7148
14		7.80	0.170	31.00	-1.7720
15		7.81	0.160	35.00	-1.8326
16		7.82	0.150	39.00	-1.8971
17		7.83	0.140	41.00	-1.9661
18		7.84	0.130	47.00	-2.0402
19		7.85	0.120	51.00	-2.1203
20		7.87	0.100	65.00	-2.3026
21		7.88	0.090	75.00	-2.4079
22		7.90	0.070	85.00	-2.6593
23		7.91	0.060	95.00	-2.8134
24		7.92	0.050	125.00	-2.9957
25		7.93	0.040	145.00	-3.2189
26		7.94	0.030	165.00	-3.5066
27		7.95	0.020	205.00	-3.9120
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*PROJECT NAME : HIRCO
*PROJECT NO : 20422.024
*WELL NO : E-7 RISE
*ANALYST : ELIAS
*DATE COLLECTED : 12-14-89
*RISER PIPE (D): (2 r sub c) = 2.0 in. = 0.0833 (radius in ft.)
*EFFECTIVE SCREEN DIAMETER: (2 r sub w) = 8.0 in. = 0.3333 (radius in ft.)
*EFFECTIVE SCREEN LENGTH: (L) = 11.60 Ft.
*MAX DRAWDOWN (IN SUBSET): (Ymax) = 0.26 Ft.
*STATIC WATER LEVEL: (SWL) = 7.97 Ft.
*DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 11.60 Ft.
*EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 173.00 Ft.
*INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 1
*SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 34.80
---LOG OF L/(r sub w) = 1.5416
FOR PARTIALLY PENETRATING WELLS--
A = 2.60
B = 0.36
FOR FULLY PENETRATING WELLS--
C = 2.03

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.3099
CONST.2 = 6.1948 =(MAX. OF 6.0)= 6.0000
LN(Re/(r sub w)) = 2.24

EFFECTIVE r sub c (for sandpack dewatering) = 0.1318
((1/T)(LN(Yo/Yt))) (SLOPE) = -1.55E-02 sec^(-1)

HYDRAULIC CONDUCTIVITY (K) = 2.61E-05 ft/sec
7.95E-04 cm/sec

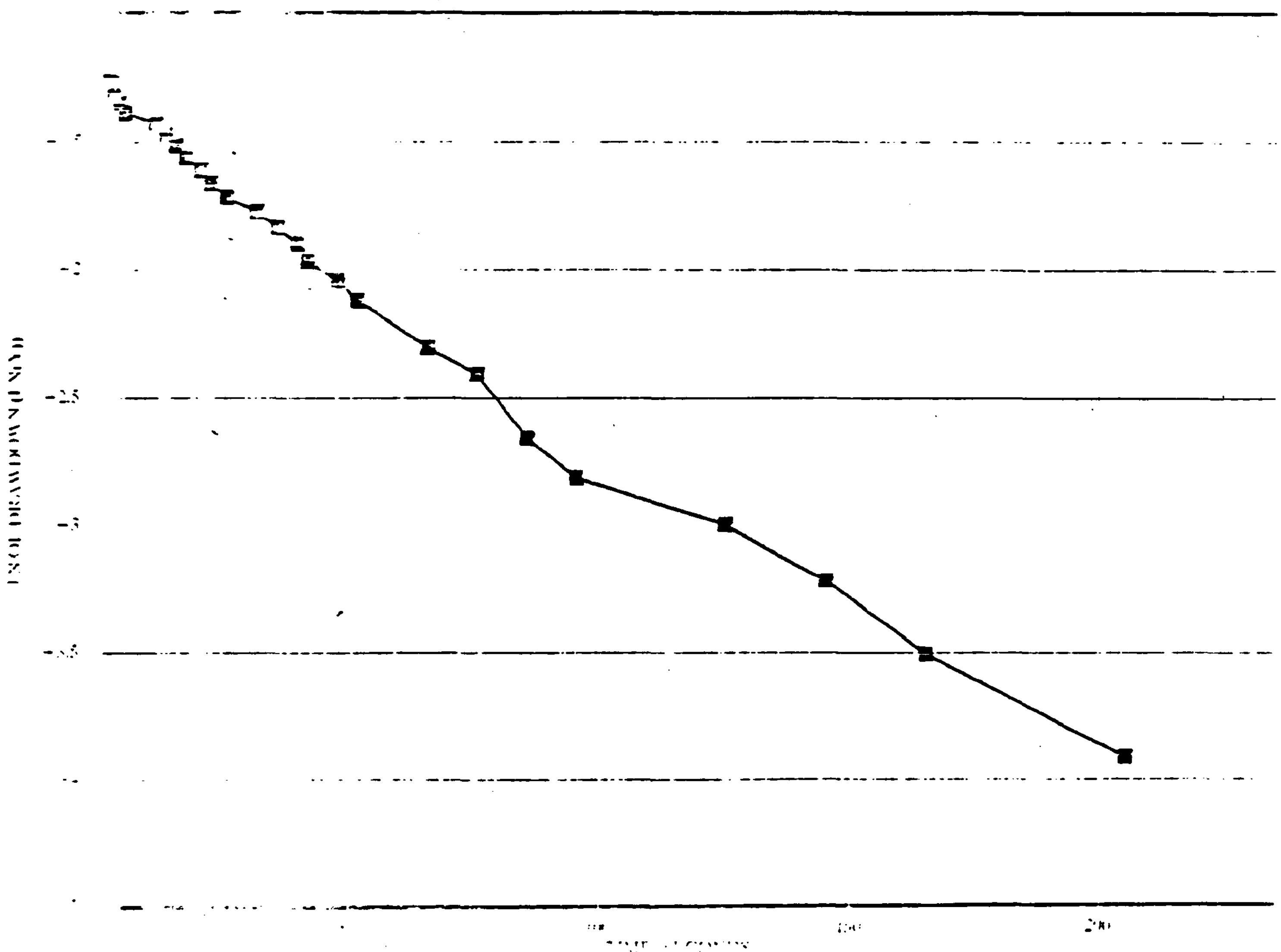
t = 4-20s

Regression Output:

Constant	-1.28E+00
Std Err of Y Est	0.0201
R Squared	0.9622
No. of Observations	7
Degrees of Freedom	5
X Coefficient(s)	-1.55E-02
Std Err of Coef.	0.0014

RATE OF RECOVERY TEST: WELL E-3

RISE



BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
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#	#TIME min	#DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (T)	LN (Y)
1		10.48	0.420	0.00	-0.8675
2		10.43	0.370	0.40	-0.9943
3		10.37	0.310	0.80	-1.1712
4		10.33	0.270	1.20	-1.3093
5		10.32	0.260	2.00	-1.3471
6		10.31	0.250	3.00	-1.3863
7		10.30	0.240	4.40	-1.4271
8		10.29	0.230	7.20	-1.4697
9		10.28	0.220	11.00	-1.5141
10		10.27	0.210	18.00	-1.5606
11		10.26	0.200	24.00	-1.6094
12		10.25	0.190	25.00	-1.6607
13		10.24	0.180	27.00	-1.7148
14		10.23	0.170	29.60	-1.7720
15		10.22	0.160	30.00	-1.8326
16		10.21	0.150	36.00	-1.8971
17		10.20	0.140	33.00	-1.9661
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#PROJECT NAME :HIRCO
#PROJECT NO : 30026.329
#WELL NO :F-2 FALL
#ANALYST :ELIAS
#DATE COLLECTED :12-3-90
#RISER PIPE (ID): (2 r sub c) = 2.0 in. = 0.0833 (radius in ft.)
#EFFECTIVE SCREEN DIAMETER: (2 r sub w) = 8.0 in. = 0.3333 (radius in ft.)
#EFFECTIVE SCREEN LENGTH: (L) = 5.00 Ft.
#MAX DRAWDOWN (IN SUBSET): (Ymax) = -0.43 Ft.
#STATIC WATER LEVEL: (SWL) = 10.06 Ft.
#DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 166.23 Ft.
#EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 175.00 Ft.
#INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 1
#SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 15.00
---LOG OF L/(r sub w) = 1.1761
FOR PARTIALLY PENETRATING WELLS--
A = 1.93
B = 0.29
FOR FULLY PENETRATING WELLS--
C = 1.38

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.1771
CONST.2 = 3.2677 =(MAX. OF 6.0)= 3.2677
LN(Re/(r sub w)) = 2.71

EFFECTIVE r sub c (for sandpack dewatering) = 0.1318
(1/T)(LN(Yo/Yt)) (SLOPE) = -8.88E-03 sec^(-1)

HYDRAULIC CONDUCTIVITY (K) = 4.17E-05 ft/sec <=================
1.27E-03 cm/sec <=================

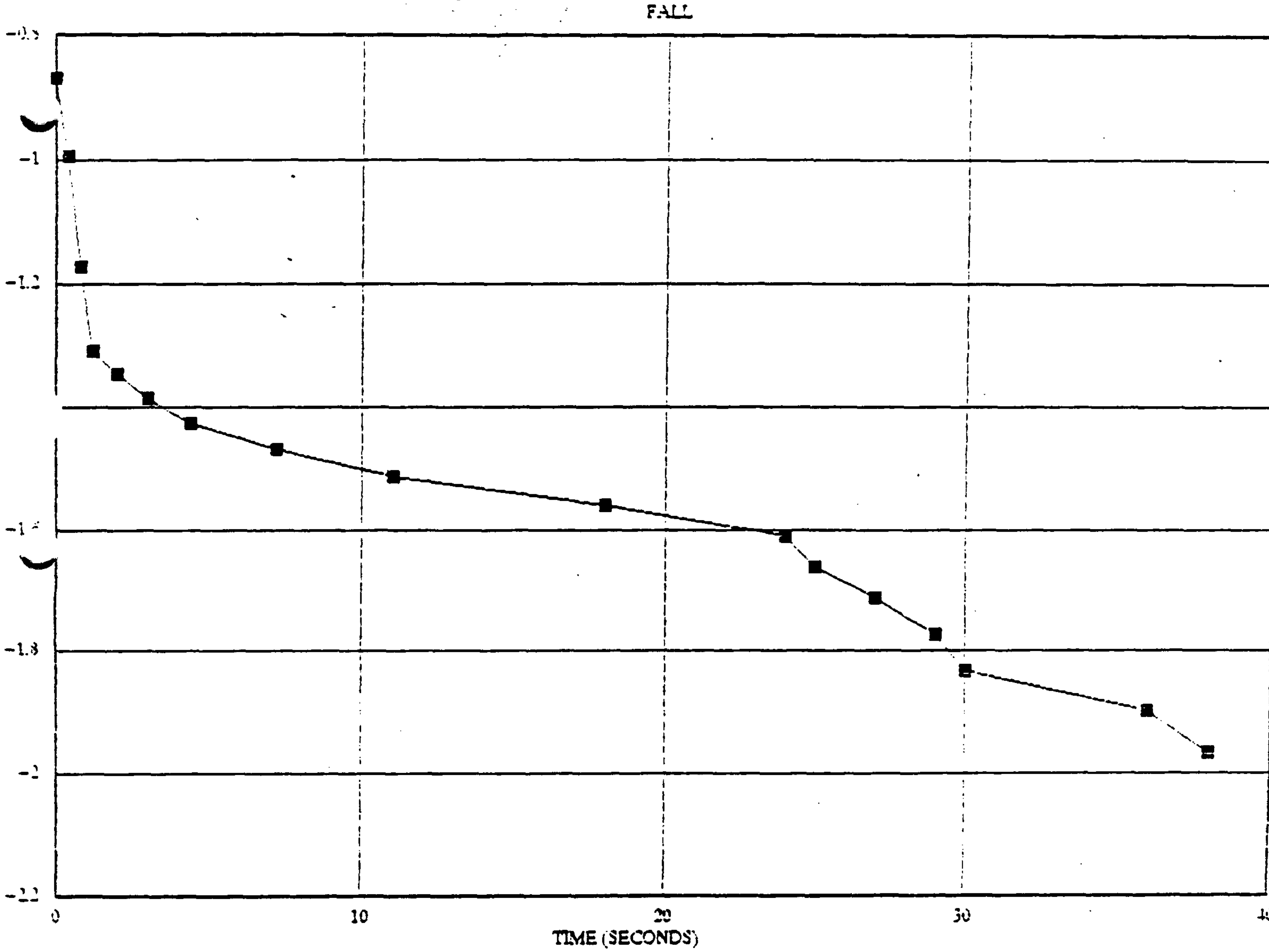
t=4.4-29 s

Regression Output:

Constant	-1.40E+00
Std Err of Y Est	0.0122
R Squared	0.9783
No. of Observations	5
Degrees of Freedom	3
(Coefficient(s)	-8.88E-03
Std Err of Coef.	0.0008

RATE OF RECOVERY TEST: WELL F-2

FALL



BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
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#	#TIME min (I)	#DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (T)	LN (Y)
1		11.80	1.340	0.00	0.2927
2		11.57	1.110	1.40	0.1044
3		11.55	1.090	1.60	0.0862
4		11.53	1.070	1.80	0.0677
5		11.51	1.050	2.00	0.0488
6		11.49	1.030	2.20	0.0296
7		11.48	1.020	2.40	0.0198
8		11.46	1.000	2.60	0.0000
9		11.45	0.990	2.80	-0.0101
10		11.43	0.970	3.00	-0.0305
11		11.42	0.960	3.20	-0.0408
12		11.40	0.940	3.40	-0.0619
13		11.38	0.920	3.60	-0.0834
14		11.37	0.910	3.80	-0.0943
15		11.35	0.890	4.00	-0.1165
16		11.34	0.880	4.20	-0.1278
17		11.33	0.870	4.40	-0.1393
18		11.31	0.850	5.40	-0.1625
19		11.26	0.800	6.40	-0.2231
20		11.20	0.740	7.40	-0.3011
21		11.14	0.680	8.40	-0.3857
22		11.09	0.630	9.40	-0.4620
23		11.05	0.590	10.40	-0.5276
24		11.00	0.540	11.40	-0.6162
25		10.96	0.500	12.40	-0.6931
26		10.93	0.470	13.40	-0.7550
27		10.89	0.430	14.40	-0.8440
28		10.86	0.400	15.40	-0.9163
29		10.83	0.370	16.40	-0.9943
30		10.80	0.340	17.40	-1.0788
31		10.78	0.320	18.40	-1.1394
32		10.75	0.290	19.40	-1.2379
33		10.72	0.260	20.40	-1.3471
34		10.70	0.240	21.40	-1.4271
35		10.68	0.220	22.40	-1.5141
36		10.65	0.190	23.40	-1.6607
37		10.63	0.170	24.40	-1.7720
38		10.62	0.160	25.40	-1.8326
39		10.60	0.140	26.40	-1.9661
40		10.59	0.130	27.40	-2.0402
41		10.58	0.120	28.40	-2.1203
42		10.56	0.100	32.40	-2.3026
43		10.54	0.080	34.40	-2.5257
44		10.52	0.060	36.40	-2.8134
45		10.51	0.050	40.40	-2.9957
46		10.50	0.040	42.40	-3.2189
47		10.49	0.030	44.40	-3.5066
48					

#PROJECT NAME : [illegible]
#PROJECT NO : [illegible]
#WELL NO : [illegible]
#ANALYST : [illegible]
#DATE COLLECTED : 04-Jan-91
#RISER PIPE (ID): (2 r sub c) = 2.0 in. = 0.0833 (radius in ft.)
#EFFECTIVE SCREEN DIAMETER: (2 r sub w) = 8.0 in. = 0.3333 (radius in ft.)
#EFFECTIVE SCREEN LENGTH: (L) = 5.00 Ft.
#MAX DRAWDOWN (IN SUBSET): (Ymax) = -1.34 Ft.
#STATIC WATER LEVEL: (SWL) = 10.46 Ft.
#DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 91.00 Ft.
#EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 175.00 Ft.
#INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 0
#SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 15.00
---LOG OF L/(r sub w) = 1.1761
FOR PARTIALLY PENETRATING WELLS--
A = 1.93
B = 0.29
FOR FULLY PENETRATING WELLS--
C = 1.38

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.1961
CONST.2 = 5.5294 =(MAX. OF 6.0)= 5.5294
LN(Re/(r sub w)) = 2.31

EFFECTIVE r sub c (for sandpack dewatering) = 0.0833
(1/T)(LN(Yo/Yt)) (SLOPE) = -8.15E-02 sec^(-1)

HYDRAULIC CONDUCTIVITY (K) = 1.31E-04 ft/sec (==================
3.99E-03 cm/sec (==================

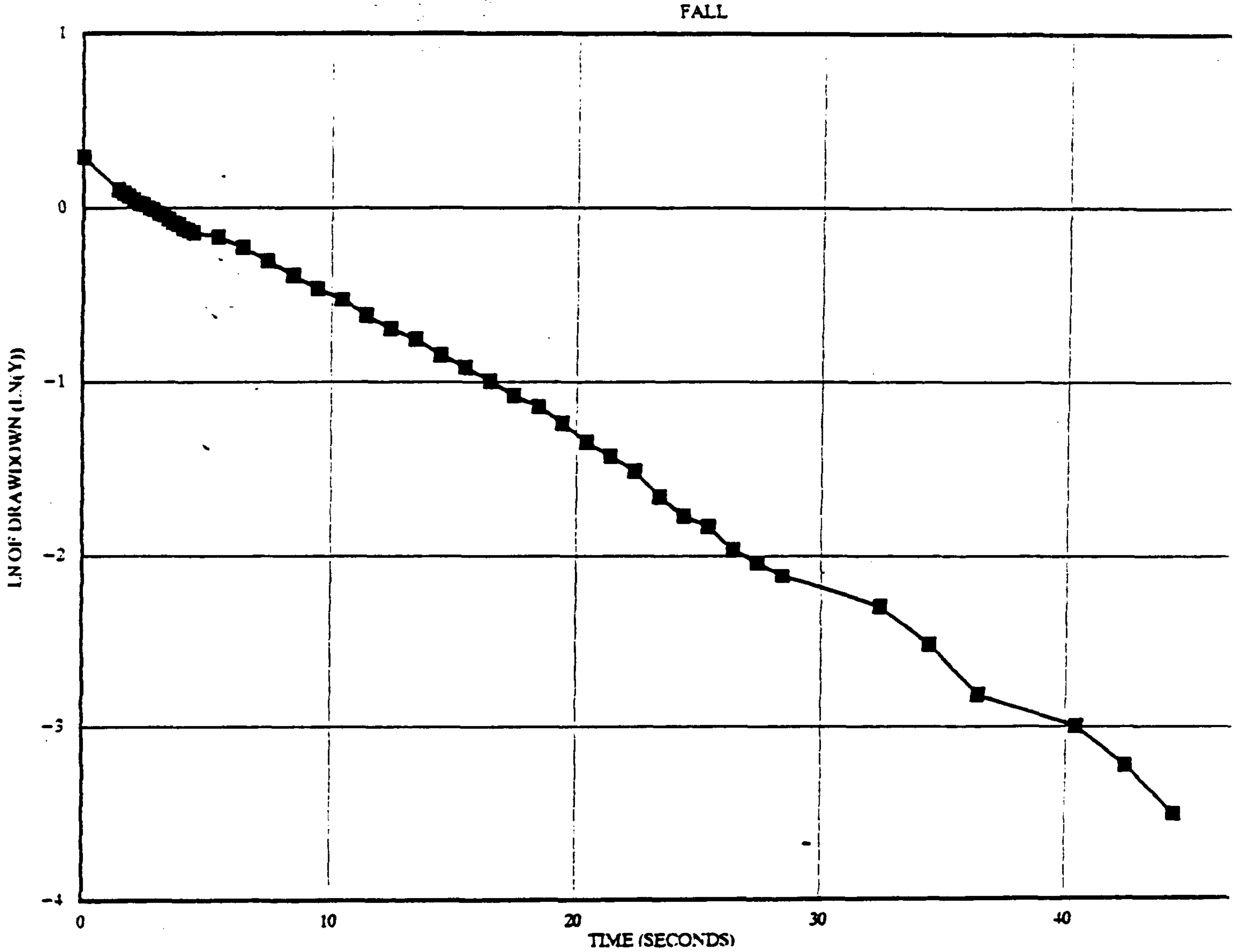
t=0-44.4s

Regression Output:

Constant	2.59E-01
Std Err of Y Est	0.0606
R Squared	0.9966
No. of Observations	47
Degrees of Freedom	45
X Coefficient(s)	-8.15E-02
Std Err of Coef.	0.0007

RATE OF RECOVERY TEST: WELL P101B

FALL



BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
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#	TIME min. (X)	DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (X)	LN (Y)
1		11.00	1.430	0.00	0.3577
2		10.99	1.420	1.00	0.3507
3		10.98	1.410	9.00	0.3436
4		10.97	1.400	16.00	0.3365
5		10.96	1.390	23.00	0.3293
6		10.95	1.380	24.00	0.3221
7		10.94	1.370	36.00	0.3148
8		10.93	1.360	41.00	0.3075
9		10.92	1.350	47.00	0.3001
10		10.91	1.340	51.00	0.2927
11		10.90	1.330	55.00	0.2852
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#PROJECT NAME : [illegible]
#PROJECT NO : [illegible]
#WELL NO : P101C FALL
#ANALYST : PUCHALSKI
#DATE COLLECTED : 04-Jan-91
#RISER PIPE (ID): (2 r sub c) = 2.0 in. = 0.0833 (radius in ft.)
#EFFECTIVE SCREEN DIAMETER: (2 r sub w) = 8.0 in. = 0.3333 (radius in ft.)
#EFFECTIVE SCREEN LENGTH: (L) = 5.00 Ft.
#MAX DRAWDOWN (IN SUBSET): (Ymax) = -1.38 Ft.
#STATIC WATER LEVEL: (SWL) = 9.57 Ft.
#DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 10.88 Ft.
#EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (B) = 175.00 Ft.
#INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 0
#SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 15.00
---LOG OF L/(r sub w) = 1.1761
FOR PARTIALLY PENETRATING WELLS--
A = 1.93
B = 0.29
FOR FULLY PENETRATING WELLS--
C = 1.38

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.3156
CONST.2 = 6.1992 =(MAX. OF 6.0)= 6.0000
LN(Re/(r sub w)) = 1.78

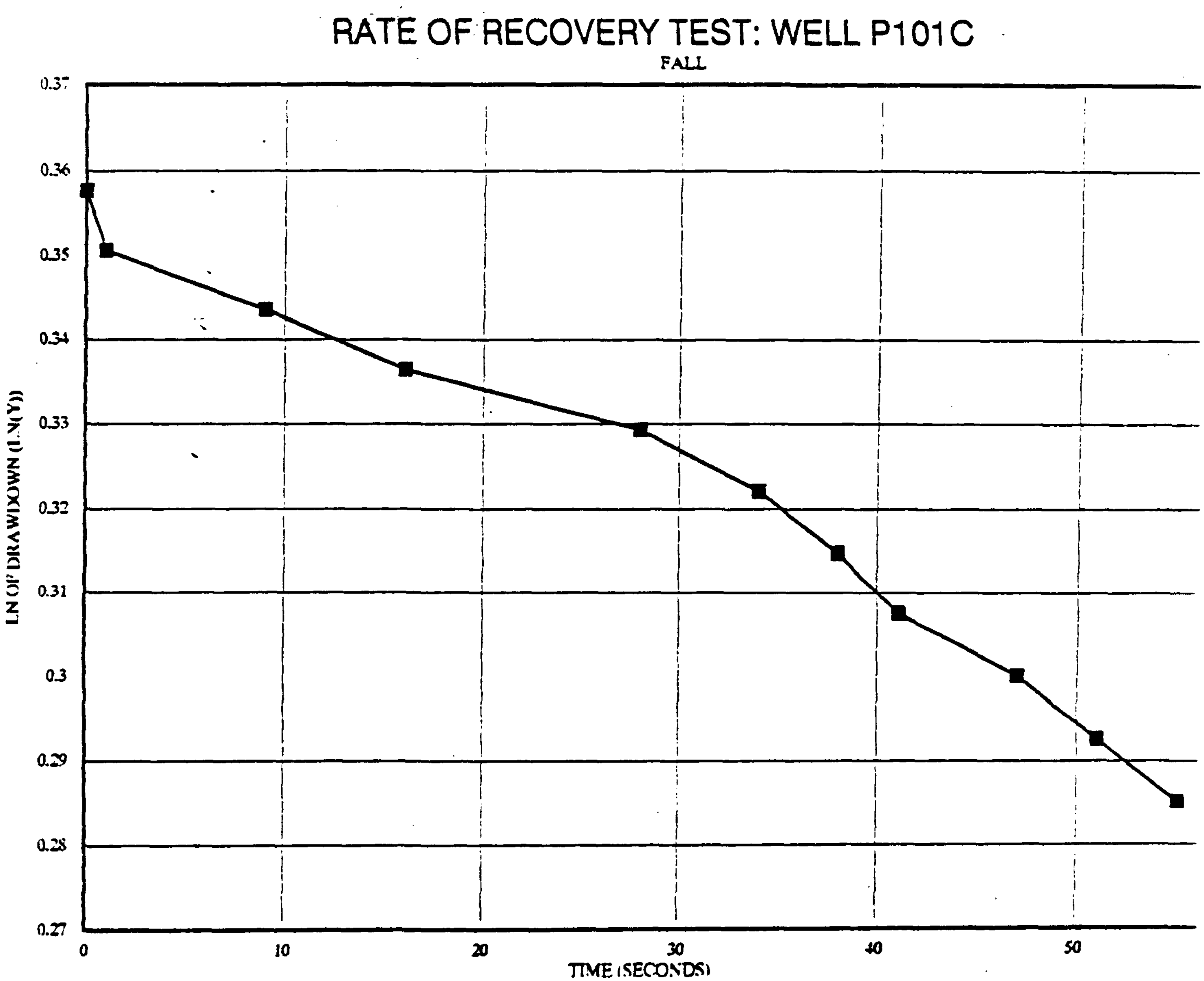
EFFECTIVE r sub c (for sandpack dewatering) = 0.0833
(1/T)(LN(Yo/Yt)) (SLOPE) = -2.94E-02 sec^(-1)

HYDRAULIC CONDUCTIVITY (K) =	3.64E-05 ft/sec	(================
	1.11E-03 cm/sec	(================

t-0-55 s

Regression Output:

Constant	2.37E-01
Std Err of Y Est	0.1530
R Squared	0.9841
No. of Observations	58
Degrees of Freedom	56
X Coefficient(s)	-2.94E-02
Std Err of Coef.	0.0005


RATE OF RECOVERY TEST: WELL P101C
FALL
LN OF DRAWDOWN (LN(Y))
TIME (SECONDS)
0.37
0.36
0.35
0.34
0.33
0.32
0.31
0.3
0.29
0.28
0.27
0
10
20
30
40
50

BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
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#	TIME min (t)	DEPTH TO WATER Ft.	DRAWDOWN (y)	TIME sec (T)	LN (Y)
1		11.25	1.490	0.00	0.3988
2		11.22	1.460	0.20	0.3784
3		10.57	0.810	0.80	-0.2107
4		10.44	0.680	1.20	-0.3857
5		10.38	0.620	1.40	-0.4796
6		10.02	0.260	1.60	-1.3471
7		9.90	0.140	1.80	-1.9661
8		9.87	0.110	2.20	-2.2073
9		9.77	0.010	2.40	-4.6052

*PROJECT NAME :HIMCO
*PROJECT NO : 2002a.024
*WELL NO :F102S FALL
*ANALYST :PUCHALSKI
*DATE COLLECTED : 04-Jan-91
*RISER PIPE (ID): (2 r sub c) = 2.0 in. = 0.0833 (radius in ft.)
*EFFECTIVE SCREEN DIAMETER: (2 r sub w) = 8.0 in. = 0.3333 (radius in ft.)
*EFFECTIVE SCREEN LENGTH: (L) = 9.00 Ft.
*MAX DRAWDOWN (IN SUBSET): (Ymax) = 1.46 Ft.
*STATIC WATER LEVEL: (SWL) = 9.76 Ft.
*DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 58.46 Ft.
*EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 175.00 Ft.
*INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 0
*SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 27.00
---LOG OF L/(r sub w) = 1.4314
FOR PARTIALLY PENETRATING WELLS--
A = 2.23
B = 0.32
FOR FULLY PENETRATING WELLS--
C = 1.74

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.2129
CONST.2 = 5.8568 =(MAX. OF 6.0)= 5.8568
LN(Re/(r sub w)) = 2.71

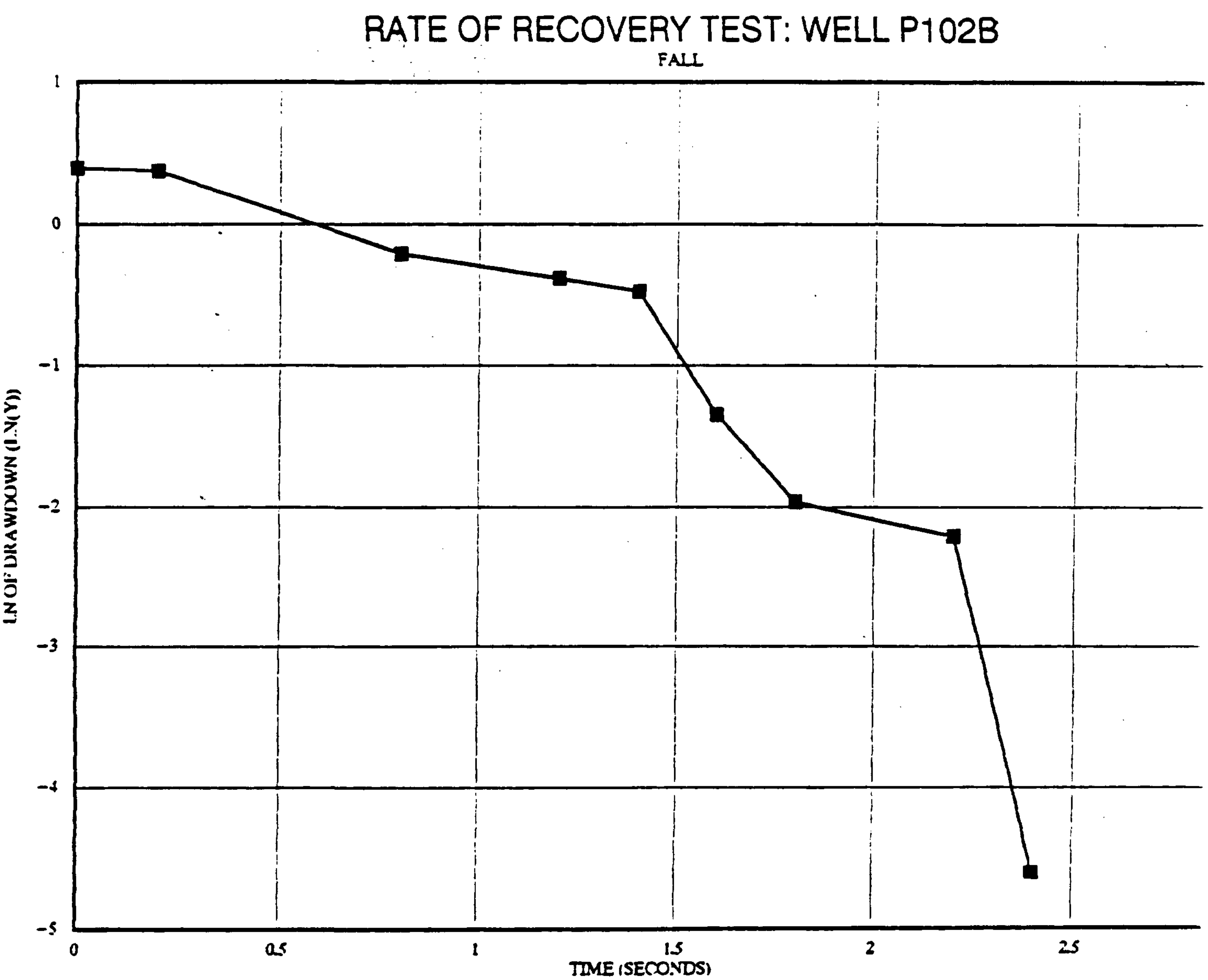
EFFECTIVE r sub c (for sandpack dewatering) = 0.0833
(1/T)(LN(Yo/Yt)) (SLOPE) = -1.23E+00 sec^(-1)

HYDRAULIC CONDUCTIVITY (K) = 1.28E-03 ft/sec (<==================
3.91E-02 cm/sec (<==================

t=0-2.2s

Regression Output:

Constant	6.85E-01
Std Err of Y Est	0.3451
R Squared	0.9865
No. of Observations	8
Degrees of Freedom	6
X Coefficient(s)	-1.23E+00
Std Err of Coef.	0.1795



RATE OF RECOVERY TEST: WELL P102B
FALL
LN OF DRAWDOWN (LN(Y))
1
0
-1
-2
-3
-4
-5
0
0.5
1
1.5
2
2.5
TIME (SECONDS)

BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
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PROGRAM CAN INCLUDE EFFECTS OF SANDPACK DEWATERING (ASSUMING WATER IS RISING WITHIN THE SANDPACK).

#	#TIME min (t)	#DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (T')	LN (Y)
1		8.83	0.930	0.00	-0.0726
2		8.91	0.850	0.20	-0.1625
3		9.01	0.750	0.40	-0.2877
4		9.11	0.650	0.60	-0.4308
5		9.22	0.540	0.80	-0.6162
6		9.32	0.440	1.00	-0.8210
7		9.44	0.320	1.20	-1.1394
8		9.52	0.240	1.40	-1.4271
9		9.61	0.150	1.60	-1.8971
10		9.72	0.040	1.80	-3.2189
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#PROJECT NAME : HIRCO
#PROJECT NO. : 30026.024
#WELL NO : P100B RISE
#ANALYST : PUCHALSKI
#DATE COLLECTED : 04-Jan-91
#RISER PIPE (ID): (2 r sub c) = 2.0 in. = 0.0833 (radius in ft.)
#EFFECTIVE SCREEN DIAMETER: (2 r sub w) = 8.0 in. = 0.3333 (radius in ft.)
#EFFECTIVE SCREEN LENGTH: (L) = 9.00 Ft.
#MAX DRAWDOWN (IN SUBSET): (Ymax) = 2.46 Ft.
#STATIC WATER LEVEL: (SWL) = 9.76 Ft.
#DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 58.46 Ft.
#EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 175.00 Ft.
#INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 0
#SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 27.00
—LOG OF L/(r sub w) = 1.4314
FOR PARTIALLY PENETRATING WELLS--
A = 2.33
B = 0.32
FOR FULLY PENETRATING WELLS--
C = 1.74

—EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.2129
CONST.2 = 5.2566 =(MAX. OF 6.0)= 5.8568
LN(Re/(r sub w)) = 2.71

EFFECTIVE r sub c (for sandpack dewatering) = 0.0833
(1/T)(LN(Yo/Yt)) (SLOPE) = -1.10E+00 sec^(-1)

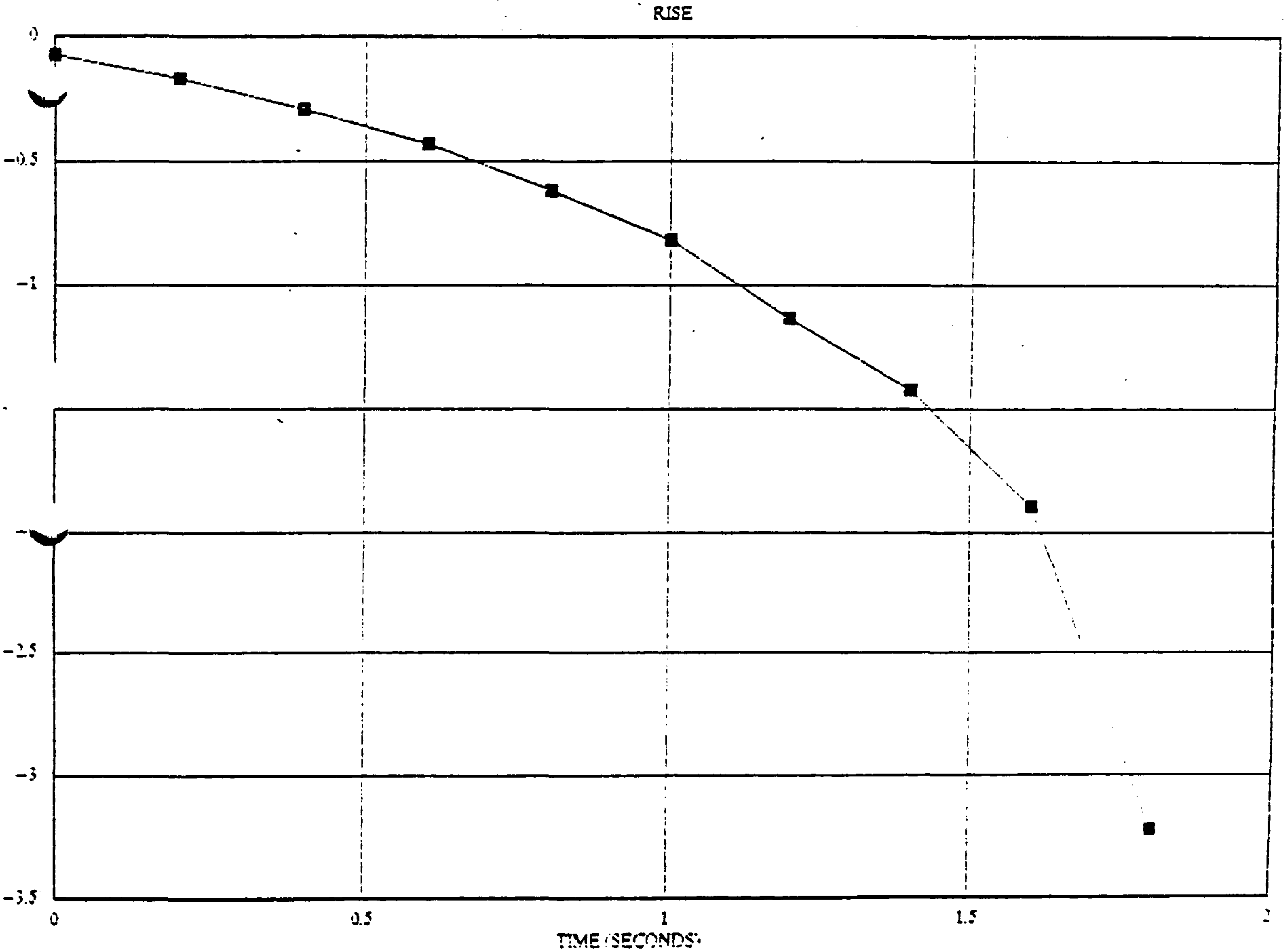
HYDRAULIC CONDUCTIVITY (K) = 1.15E-03 ft/sec <==================
3.50E-02 cm/sec <==================

t=0-1.6s

Regression Output:

Constant	1.17E-01
Std Err of Y Est	0.1557
R Squared	0.9447
No. of Observations	9
Degrees of Freedom	7
X Coefficient(s)	-1.10E+00
Std Err of Coef.	0.1005

RATE OF RECOVERY TEST: WELL P102B



BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
TO UTILIZE THIS WORKSHEET, ENTER YOUR DATA AT LOCATIONS MARKED BY AN "*".
PROGRAM CAN INCLUDE EFFECTS OF SANDPACK DEWATERING (ASSUMING WATER IS RISING WITHIN THE SANDPACK).

#	*TIME min (t)	*DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (T)	LN (Y)
1		10.45	0.840	1.20	-0.1744
2		10.47	0.820	1.40	-0.1985
3		10.48	0.810	1.60	-0.2107
4		10.49	0.800	1.80	-0.2231
5		10.50	0.790	2.00	-0.2357
6		10.51	0.780	2.20	-0.2485
7		10.52	0.770	2.40	-0.2614
8		10.53	0.760	2.60	-0.2744
9		10.54	0.750	2.80	-0.2877
10		10.55	0.740	3.00	-0.3011
11		10.56	0.730	3.20	-0.3147
12		10.57	0.720	3.40	-0.3285
13		10.58	0.710	3.60	-0.3425
14		10.59	0.700	3.80	-0.3567
15		10.60	0.690	4.00	-0.3711
16		10.61	0.680	4.20	-0.3857
17		10.62	0.670	4.40	-0.4005
18		10.63	0.660	5.40	-0.4155
19		10.64	0.650	6.40	-0.4308
20		10.65	0.640	7.40	-0.4463
21		10.66	0.630	8.40	-0.4620
22		10.67	0.620	9.40	-0.4780
23		10.68	0.610	10.40	-0.4943
24		10.69	0.600	11.40	-0.5108
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*PROJECT NAME : MINCO
*PROJECT NO : 20026.024
*WELL NO : F102C RISE
*ANALYST : PUCHALSKI
*DATE COLLECTED : 04-Jan-91
*RISER PIPE I.D. : (2 r sub c) = 2.0 in. = 0.0833 (radius in ft.)
*EFFECTIVE SCREEN DIAMETER: (2 r sub w) = 8.0 in. = 0.3333 (radius in ft.)
*EFFECTIVE SCREEN LENGTH: (L) = 5.00 Ft.
*MAX DRAWDOWN (IN SUBSET): (Ymax) = 0.82 Ft.
*STATIC WATER LEVEL: (SWL) = 11.29 Ft.
*DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 149.40 Ft.
*EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 175.00 Ft.
*INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 0
*SANDPACK % SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 15.00
---LOG OF L/(r sub w) = 1.1761
FOR PARTIALLY PENETRATING WELLS--
A = 1.93
B = 0.29
FOR FULLY PENETRATING WELLS--
C = 1.38

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.1802
CONST.2 = 4.3412 =(MAX. OF 6.0)= 4.3412
LN(Re/(r sub w)) = 2.34

EFFECTIVE r sub c (for sandpack dewatering) = 0.0833
(1/T)(LN(Yo/Yt)) (SLOPE) = -6.68E-02 sec^(-1)

HYDRAULIC CONDUCTIVITY (K) = 1.18E-04 ft/sec
3.59E-03 cm/sec

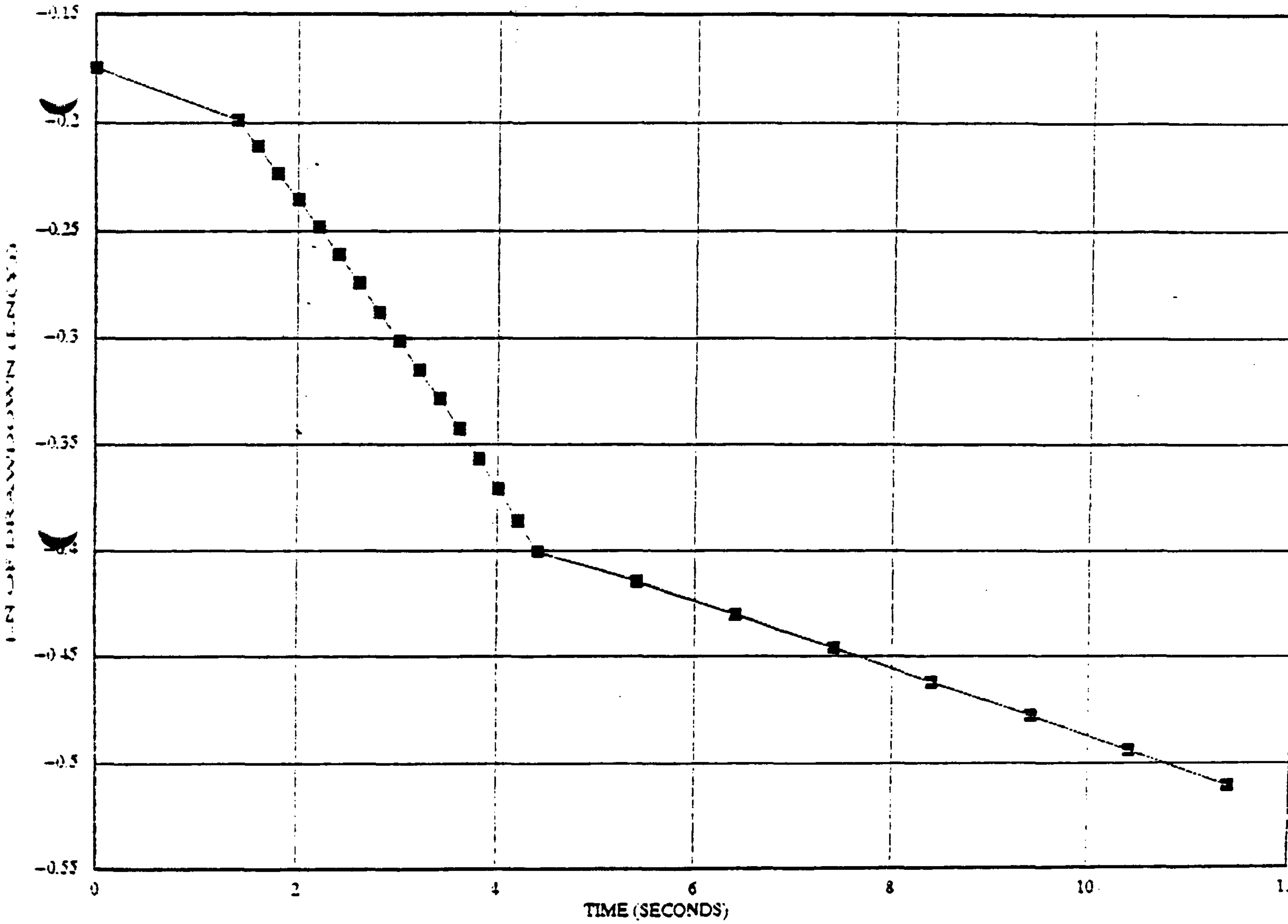
t=1.4-4.2s

Regression Output:

Constant	-1.02E-01
Std Err of Y Est	0.0016
R Squared	0.9993
No. of Observations	15
Degrees of Freedom	13
X Coefficient(s)	-6.68E-02
Std Err of Coef.	0.0005

RATE OF RECOVERY TEST: WELL P102C

RISE



BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
TO UTILIZE THIS WORKSHEET, ENTER YOUR DATA AT LOCATIONS MARKED BY AN "#"...
PROGRAM CAN INCLUDE EFFECTS OF SANDPACK DEWATERING (ASSUMING WATER IS RISING WITHIN THE SANDPACK).

#	#TIME min. (t)	#DEPTH TO WATER Ft.	DRAWDOWN (y)	TIME sec (t)	LN (y)
1		8.95	1.930	0.00	0.6575
2		8.30	1.280	0.90	0.2469
3		7.25	0.230	1.00	-1.4697
4		7.21	0.190	2.00	-1.6607
5		7.17	0.150	2.40	-1.8971
6		7.14	0.120	2.80	-2.1203
7		7.13	0.110	3.00	-2.2073
8		7.12	0.100	4.00	-2.3026
9		7.11	0.090	4.40	-2.4079
10		7.10	0.080	4.80	-2.5257
11		7.09	0.070	5.00	-2.6593
12		7.08	0.060	5.80	-2.8134
13		7.07	0.050	7.00	-2.9957
14		7.06	0.040	9.00	-3.2189
15		7.05	0.030	11.00	-3.5066
16		7.04	0.020	16.00	-3.9120
17		7.03	0.010	22.00	-4.6052
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#PROJECT NAME : HOOD
#PROJECT NO : 2002e.024
#WELL NO : MW-1014 FALL
#ANALYST : ELIAS
#DATE COLLECTED : 12-1-90
#RISER PIPE ID: (2 r sub c) = 2.0 in. = 0.0833 (radius in ft.)
#EFFECTIVE SCREEN DIAMETER: (2 r sub w) = 8.0 in. = 0.3333 (radius in ft.)
#EFFECTIVE SCREEN LENGTH: (L) = 7.44 Ft.
#MAX DRAWDOWN (IN SUBSET): (Ymax) = -1.90 Ft.
#STATIC WATER LEVEL: (SWL) = 7.02 Ft.
#DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 8.64 Ft.
#EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 175.00 Ft.
#INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 1
#SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 22.32
—LOG OF L/(r sub w) = 1.3487
FOR PARTIALLY PENETRATING WELLS—
A = 2.17
B = 0.31
FOR FULLY PENETRATING WELLS—
C = 1.59

—EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.3379
CONST.2 = 6.2128 =(MAX. OF 6.0)= 6.0000
LN(Re/(r sub w)) = 1.93

EFFECTIVE r sub c (for sandpack dewatering) = 0.1318
(1/T)(LN(Yo/Yt)) (SLOPE) = -1.30E-01 sec^(-1)

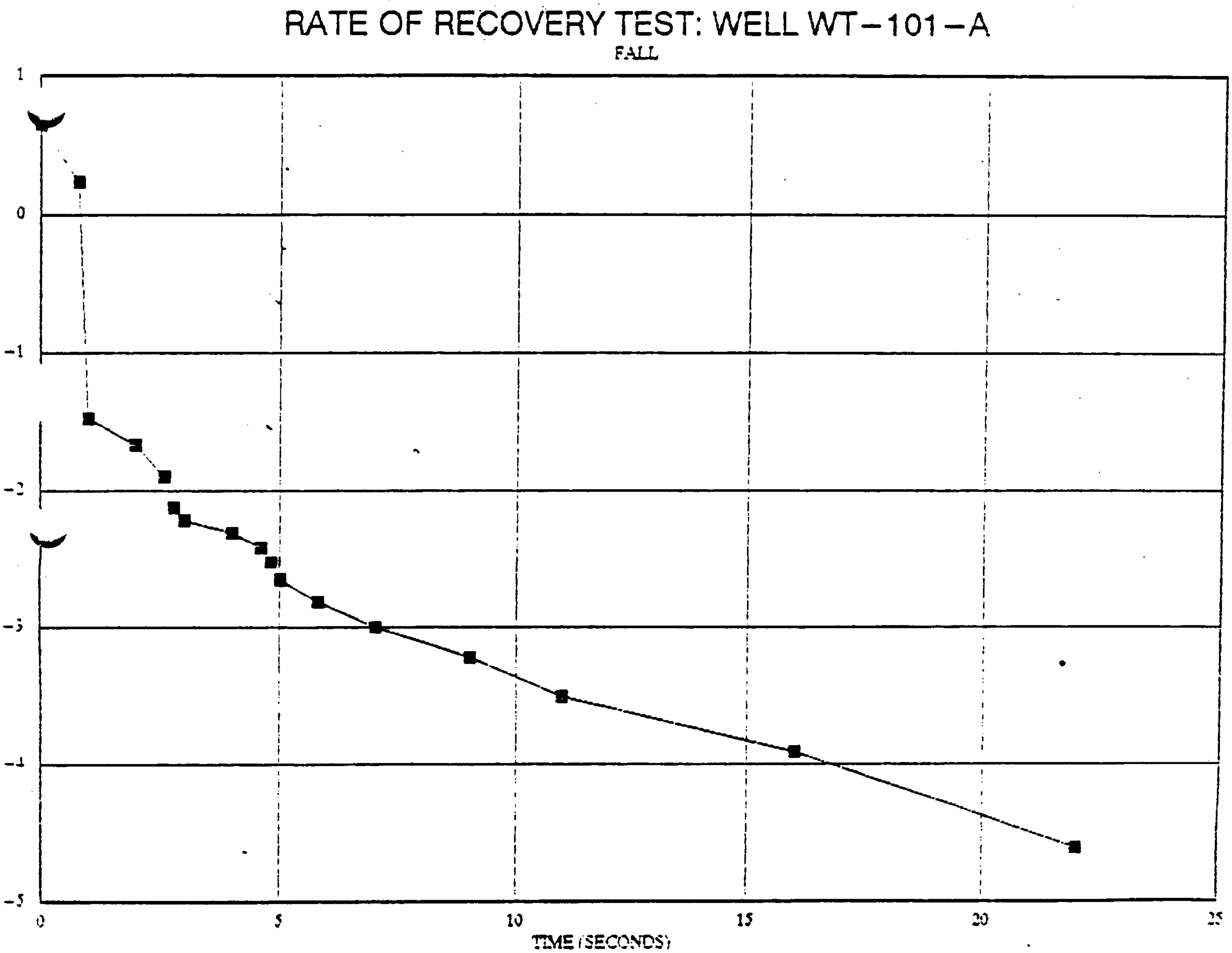
HYDRAULIC CONDUCTIVITY (K) = 3.10E-04 ft/sec
9.45E-03 cm/sec

t=2.-22s

Regression Output:

Constant	-1.90E+00
Std Err of Y Est	0.2057
R Squared	0.9411
No. of Observations	14
Degrees of Freedom	12
X Coefficient(s)	-1.30E-01
Std Err of Coef.	0.0099

BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
TO UTILIZE THIS WORKSHEET, ENTER YOUR DATA AT LOCATIONS MARKED BY AN "#".



RATE OF RECOVERY TEST: WELL WT-101-A
FALL
TIME (SECONDS)

BOUWER AND RICE METHOD: EFFECTS OF SANDPACK DEWATERING ASSUMING WATER IS RISING WITHIN THE SANDPACK

#	TIME min (t)	DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (T)	LN (Y)
1		6.35	0.670	0.00	-0.4005
2		6.40	0.620	0.20	-0.4780
3		6.52	0.500	0.40	-0.6931
4		6.64	0.380	0.60	-0.9676
5		6.73	0.290	0.80	-1.2379
6		6.80	0.220	1.00	-1.5141
7		6.83	0.190	1.20	-1.6607
8		6.87	0.150	1.40	-1.8971
9		6.89	0.130	1.60	-2.0402
10		6.91	0.110	1.80	-2.2073
11		6.93	0.090	2.00	-2.4079
12		6.95	0.070	2.20	-2.6593
13		6.96	0.060	2.40	-2.8134
14		6.97	0.050	2.60	-2.9957
15		6.98	0.040	2.80	-3.2189
16		6.99	0.030	3.00	-3.5066
17		7.00	0.020	3.20	-3.9120
18		7.01	0.010	9.20	-4.6052
19		7.02	0.000	19.20	ERR

PROJECT NAME : MIMCO
PROJECT NO : 20026.024
WELL NO : MT-101A RISE
ANALYST : ELIAS
DATE COLLECTED : 12-1-90
RISER PIPE (ID): (2 * sub c) = 2.0 in. = 0.0833 (radius in ft.)
EFFECTIVE SCREEN DIAMETER: (2 * sub e) = 8.0 in. = 0.3333 (radius in ft.)
EFFECTIVE SCREEN LENGTH: (L) = 7.44 Ft.
MAX DRAWDOWN (IN SUBSET): (Ymax) = 0.67 Ft.
STATIC WATER LEVEL: (SWL) = 7.02 Ft.
DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 5.94 Ft.
EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 175.00 Ft.
INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 0
SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub e) = 22.32
---LOG OF L/(r sub e) = 1.3487
FOR PARTIALLY PENETRATING WELLS---
A = 2.17
B = 0.31
FOR FULLY PENETRATING WELLS---
C = 1.59

---EVALUATION OF LN(Re/(r sub e)):
CONST.1 = 0.3379
CONST.2 = 6.2128 =(MAX. OF 6.0)= 6.0000
LN(Re/(r sub e)) = 1.95

EFFECTIVE r sub c (for sandpack dewatering) = 0.0833
(1/T)(LN(Yo/Yt)) (SLOPE) = -9.77E-01 sec^(-1)

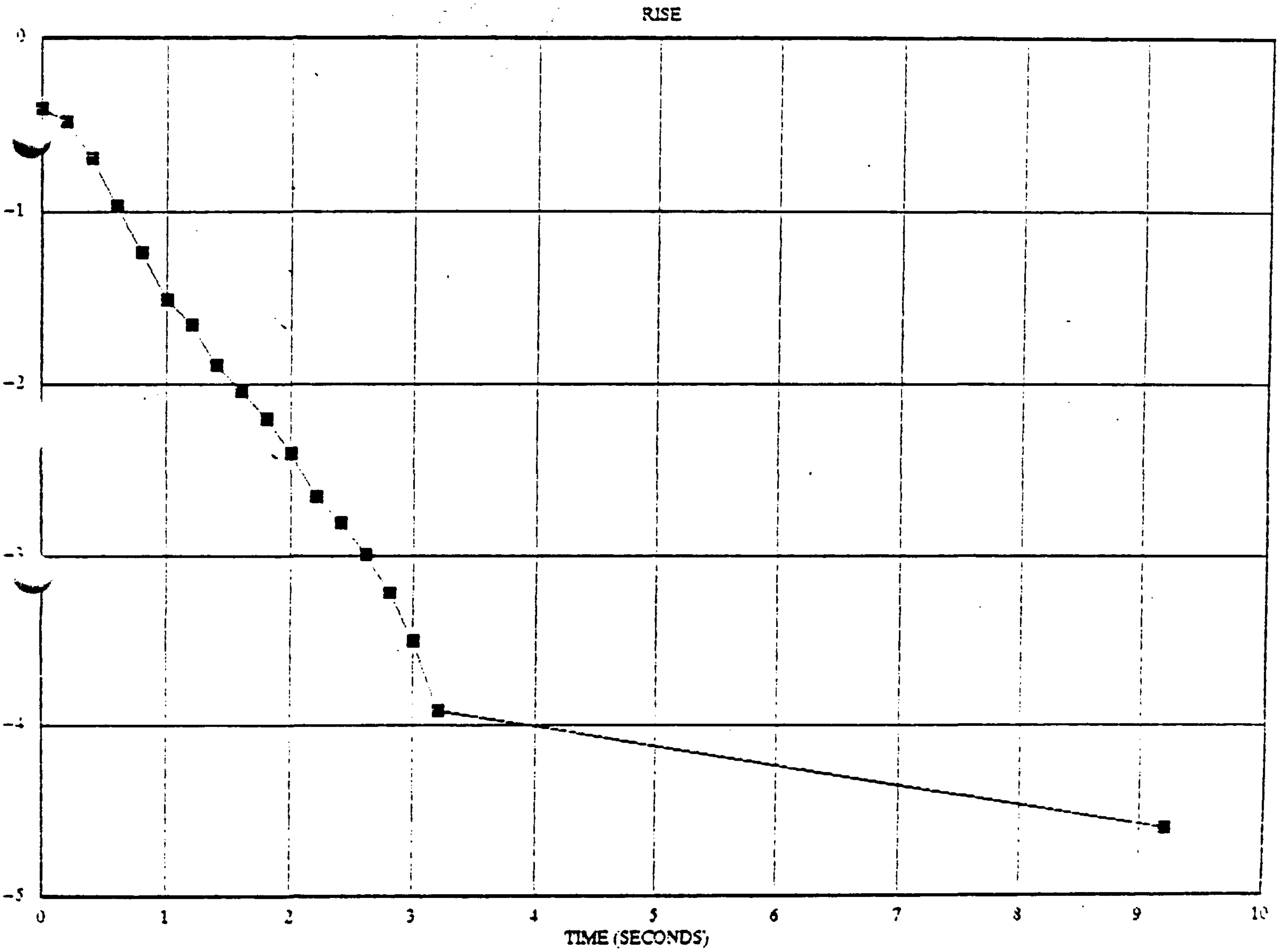
HYDRAULIC CONDUCTIVITY (K) = 8.81E-04 ft/sec
2.69E-02 cm/sec

t=1-3s

Regression Output:

Constant	-4.94E-01
Std Err of Y Est	0.0425
R Squared	0.9961
No. of Observations	11
Degrees of Freedom	9
X Coefficient(s)	-9.77E-01
Std Err of Coef.	0.0202

RATE OF RECOVERY TEST: WELL WT-101-A



BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
TO UTILIZE THIS WORKSHEET, ENTER YOUR DATA AT LOCATIONS MARKED BY AN "#".
PROGRAM CAN INCLUDE EFFECTS OF SANDPACK DEWATERING (ASSUMING WATER IS RISING WITHIN THE SANDPACK).

#	#TIME min (X)	#DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (X')	LN (Y)
1		7.02	0.000	0.00	ERR
2		7.94	0.920	1.00	-0.0574
3		7.21	0.190	2.60	-1.6607
4		7.16	0.140	3.00	-1.9661
5		7.13	0.110	3.60	-2.2073
6		7.12	0.100	3.80	-2.3026
7		7.11	0.090	4.00	-2.4079
8		7.10	0.080	4.80	-2.5257
9		7.09	0.070	5.00	-2.6593
10		7.08	0.060	5.30	-2.8134
11		7.07	0.050	8.30	-2.9957
12		7.06	0.040	10.00	-3.2189
13		7.05	0.030	13.00	-3.5066
14		7.04	0.020	16.00	-3.9120
15		7.03	0.010	22.00	-4.6052
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17			7.020		
18			7.020		
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#PROJECT NAME : HINCO
#PROJECT NO : 20026.024
#WELL NO : MT-102A FALL
#ANALYST : ELIAS
#DATE COLLECTED : 10-?-90
#RAISER PIPE (ID): (2 r sub c) = 2.0 in. = 0.0833 (radius in ft.)
#EFFECTIVE SCREEN DIAMETER: (2 r sub w) = 8.0 in. = 0.3333 (radius in ft.)
#EFFECTIVE SCREEN LENGTH: (L) = 10.29 Ft.
#MAX DRAWDOWN (IN SUBSET): (ymax) = -0.01 Ft.
#STATIC WATER LEVEL: (SWL) = 7.02 Ft.
#DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 10.29 Ft.
#EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 175.00 Ft.
#INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 1
#SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 30.87
---LOG OF L/(r sub w) = 1.4895
FOR PARTIALLY PENETRATING WELLS--
A = 2.47
B = 0.34
FOR FULLY PENETRATING WELLS--
C = 1.86

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.2207
CONST.2 = 6.2023 =(MAX. OF 6.0)= 6.0000
LN(Re/(r sub w)) = 2.14

EFFECTIVE r sub c (for sandpack dewatering) = 0.1318
(1/T)(LN(Yo/Yt)) (SLOPE) = -1.23E-01 sec^(-1)

HYDRAULIC CONDUCTIVITY (K) = 2.23E-04 ft/sec
6.80E-03 cm/sec

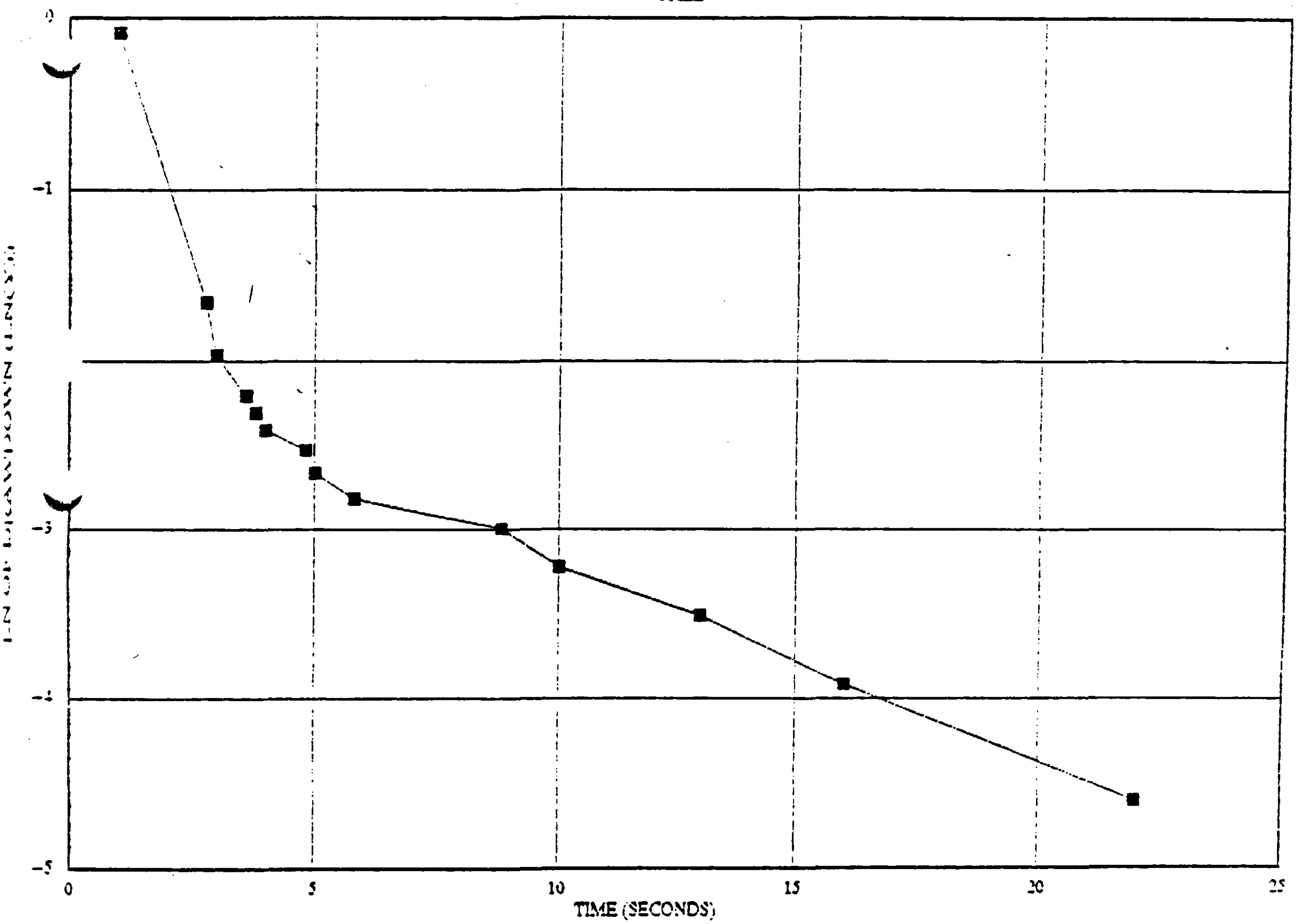
t = 36-22 s

Regression Output:

Constant	-1.93E+00
Std Err of Y Est	0.0966
R Squared	0.9849
No. of Observations	11
Degrees of Freedom	9
X Coefficient(s)	-1.23E-01
Std Err of Coef.	0.0051

RATE OF RECOVERY TEST: WELL WT-102-A

FALL



BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS; FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
TO UTILIZE THIS WORKSHEET, ENTER YOUR DATA AT LOCATIONS MARKED BY AN "#".
PROGRAM CAN INCLUDE EFFECTS OF SANDPACK DEWATERING (ASSUMING WATER IS RISING WITHIN THE SANDPACK).

#	TIME min (t)	DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (T)	LN (Y)
1		5.94	4.250	0.00	1.4702
2		6.25	4.040	1.60	1.3962
3		6.48	3.810	1.80	1.3376
4		6.58	3.710	2.00	1.3110
5		6.67	3.620	2.20	1.2865
6		6.73	3.560	2.40	1.2698
7		6.78	3.510	2.60	1.2556
8		6.82	3.470	2.80	1.2442
9		6.85	3.440	3.00	1.2355
10		6.88	3.410	3.20	1.2267
11		6.89	3.400	3.40	1.2238
12		6.90	3.390	3.60	1.2208
13		6.92	3.370	3.80	1.2149
14		6.93	3.360	4.00	1.2119
15		6.94	3.350	4.40	1.2090
16		6.95	3.340	4.80	1.2060
17		6.96	3.330	5.00	1.2030
18		6.97	3.320	6.00	1.2000
19		6.98	3.310	7.00	1.1969
20		6.99	3.300	10.00	1.1939
21		7.00	3.290	13.00	1.1909
22		7.01	3.280	20.00	1.1878
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#PROJECT NAME : HIMCO
#PROJECT NO : 20026.024
#WELL NO : MW-10CA RISE
#ANALYST : ELIAS
#DATE COLLECTED : 12-14-90
#RISER PIPE (ID): 2 r sub c) = 2.0 in. = 0.0833 (radius in ft.)
#EFFECTIVE SCREEN DIAMETER: 2 r sub w) = 8.0 in. = 0.3333 (radius in ft.)
#EFFECTIVE SCREEN LENGTH: (L) = 11.09 Ft.
#MAX DRAWDOWN (IN SUBSET): (Ymax) = 4.04 Ft.
#STATIC WATER LEVEL: (SWL) = 10.29 Ft.
#DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 9.53 Ft.
#EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 12.33 Ft.
#INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 1
#SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 33.27
---LOG OF L/(r sub w) = 1.5221
FOR PARTIALLY PENETRATING WELLS--
A = 2.55
B = 0.35
FOR FULLY PENETRATING WELLS--
C = 1.97

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.3281
CONST.2 = 2.1282 =(MAX. OF 6.0)= 2.1282
LN(Re/(r sub w)) = 2.34

EFFECTIVE r sub c (for sandpack dewatering) = 0.1318
(1/T)(LN(Yo/Yt)) (SLOPE) = -7.41E-02 sec^(-1)

HYDRAULIC CONDUCTIVITY (K) = 1.36E-04 ft/sec (<==================
4.14E-03 cm/sec (<==================

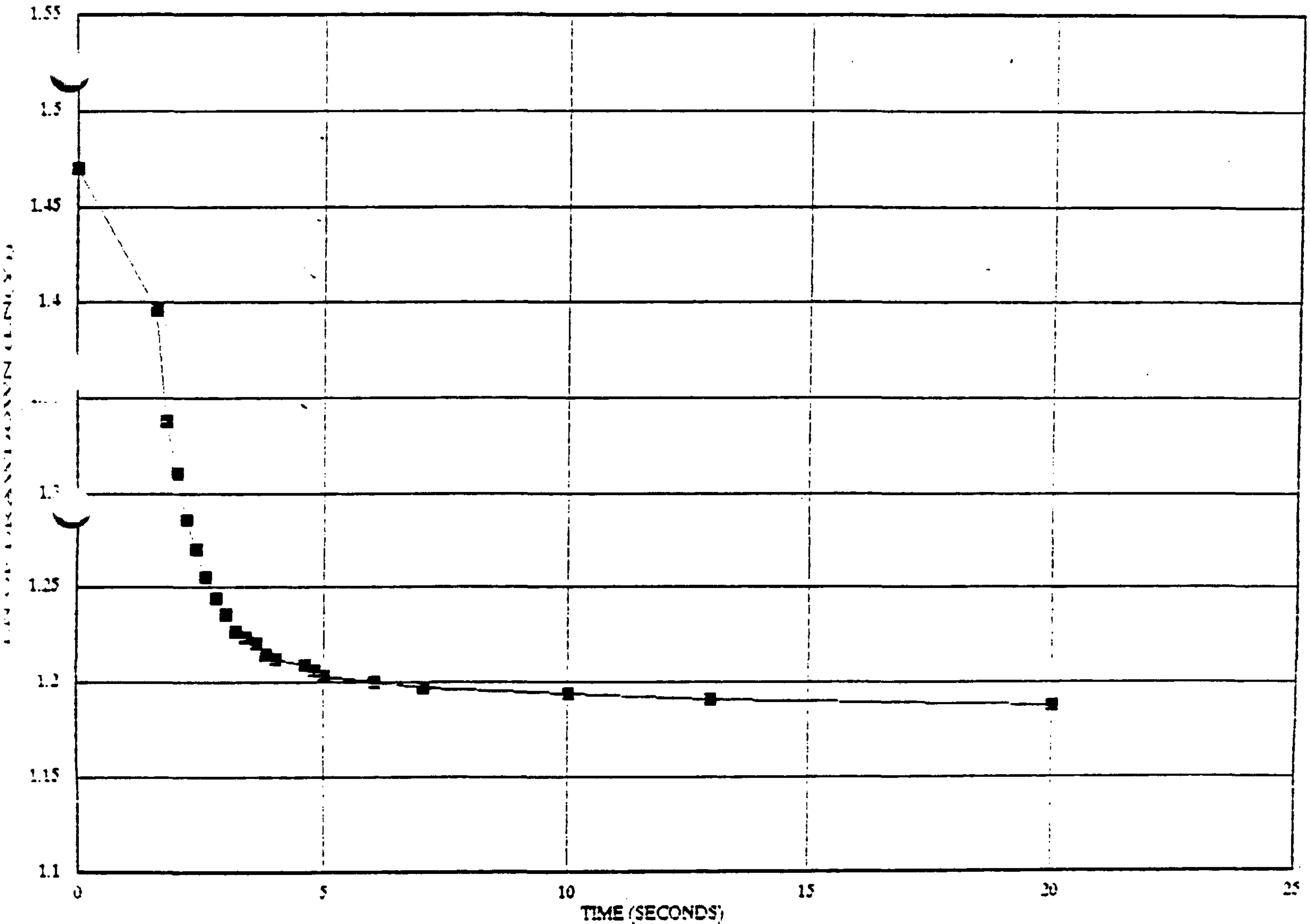
t = 2-4 s

Regression Output:

Constant	1.45E+00
Std Err of Y Est	0.0056
R Squared	0.9686
No. of Observations	6
Degrees of Freedom	4
X Coefficient(s)	-7.41E-02
Std Err of Coef.	0.0067

RATE OF RECOVERY TEST: WELL WT-102A

RISE



BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
TO UTILIZE THIS WORKSHEET, ENTER YOUR DATA AT LOCATIONS MARKED BY AN "*".
PROGRAM CAN INCLUDE EFFECTS OF SANDPACK DEWATERING (ASSUMING WATER IS RISING WITHIN THE SANDPACK).

#	TIME min (T)	DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (T')	LN (Y)
1		7.95	0.000	0.00	ERR
2		8.30	0.320	0.20	-1.1394
3		8.26	0.280	0.60	-1.2730
4		8.21	0.230	0.80	-1.4697
5		8.18	0.200	1.00	-1.6094
6		8.15	0.170	1.20	-1.7720
7		8.07	0.090	1.40	-2.4079
8		8.06	0.080	1.60	-2.5257
9		8.03	0.050	1.80	-2.9957
10		8.00	0.020	2.00	-3.9120
11		7.95	0.000	2.20	ERR

*PROJECT NAME : HIMCO
*PROJECT NO : 3002a.024
*WELL NO : MT-103A FALL
*ANALYST : ELIAS
*DATE COLLECTED : 12-14-90
*RISER PIPE (ID): (2 r sub c) = 2.0 in. = 0.0833 (radius in ft.)
*EFFECTIVE SCREEN DIAMETER: (2 r sub w) = 8.0 in. = 0.3333 (radius in ft.)
*EFFECTIVE SCREEN LENGTH: (L) = 6.46 Ft.
*MAX DRAWDOWN (IN SUBSET): (Ymax) = 0.30 Ft.
*STATIC WATER LEVEL: (SWL) = 7.98 Ft.
*DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 6.46 Ft.
*EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 12.33 Ft.
*INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 0
*SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 19.38
---LOG OF L/(r sub w) = 1.2874
FOR PARTIALLY PENETRATING WELLS--
A = 2.07
B = 0.38
FOR FULLY PENETRATING WELLS--
C = 1.58

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.3711
CONST.2 = 2.8685 =(MAX. OF 6.0)= 2.8685
LN(Re/(r sub w)) = 1.72

EFFECTIVE r sub c (for sandpack dewatering) = 0.0833
(1/T)(LN(Yo/Yt)) (SLOPE) = -5.97E-01 sec^(-1)

HYDRAULIC CONDUCTIVITY (K) = 6.10E-04 ft/sec <==============
1.86E-02 cm/sec <==============

t=0.2-1s

Regression Output:

Constant	-9.89E-01
Std Err of Y Est	0.0590
R Squared	0.9464
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	-5.97E-01
Std Err of Coef.	0.0997

BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
TO UTILIZE THIS WORKSHEET, ENTER YOUR DATA AT LOCATIONS MARKED BY AN "*".
PROGRAM CAN INCLUDE EFFECTS OF SANDPACK DEWATERING (ASSUMING WATER IS RISING WITHIN THE SANDPACK).

#	*TIME min (T)	*DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (T')	LN (Y)
1		7.96	0.300	0.00	ERR
2		8.[illegible]	0.320	0.20	-1.1394
3		8.25	0.290	0.60	-1.[illegible]
4		8.21	0.230	0.90	-1.4677
5		8.18	0.200	1.00	-1.6094
6		8.15	0.170	1.20	-1.7720
7		8.07	0.090	1.40	-2.4079
8		8.04	0.080	1.60	-2.5257
9		8.03	0.050	1.80	-2.9957
10		8.00	0.020	2.00	-3.9120
11		7.98	0.000	2.20	ERR

*PROJECT NAME : HIMCO
*PROJECT NO : 3003a.024
*WELL NO : MW-103A FALL
*ANALYST : ELIAS
*DATE COLLECTED : 12-14-90
*RISER PIPE I.D.: (2 r sub c) = 2.0 in. = 0.0833 (radius in ft.)
*EFFECTIVE SCREEN DIAMETER: (2 r sub w) = 8.0 in. = 0.3333 (radius in ft.)
*EFFECTIVE SCREEN LENGTH: (L) = 6.46 Ft.
*MAX DRAWDOWN (IN SUBSET): (Ymax) = 0.32 Ft.
*STATIC WATER LEVEL: (SWL) = 7.98 Ft.
*DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 6.46 Ft.
*EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 12.33 Ft.
*INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 0
*SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 19.38
---LOG OF L/(r sub w) = 1.2874
FOR PARTIALLY PENETRATING WELLS--
A = 2.07
B = 0.38
FOR FULLY PENETRATING WELLS--
C = 1.50

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.3711
CONST.2 = 2.5685 =(MAX. OF 6.0)= 2.5685
LN(Re/(r sub w)) = 1.92

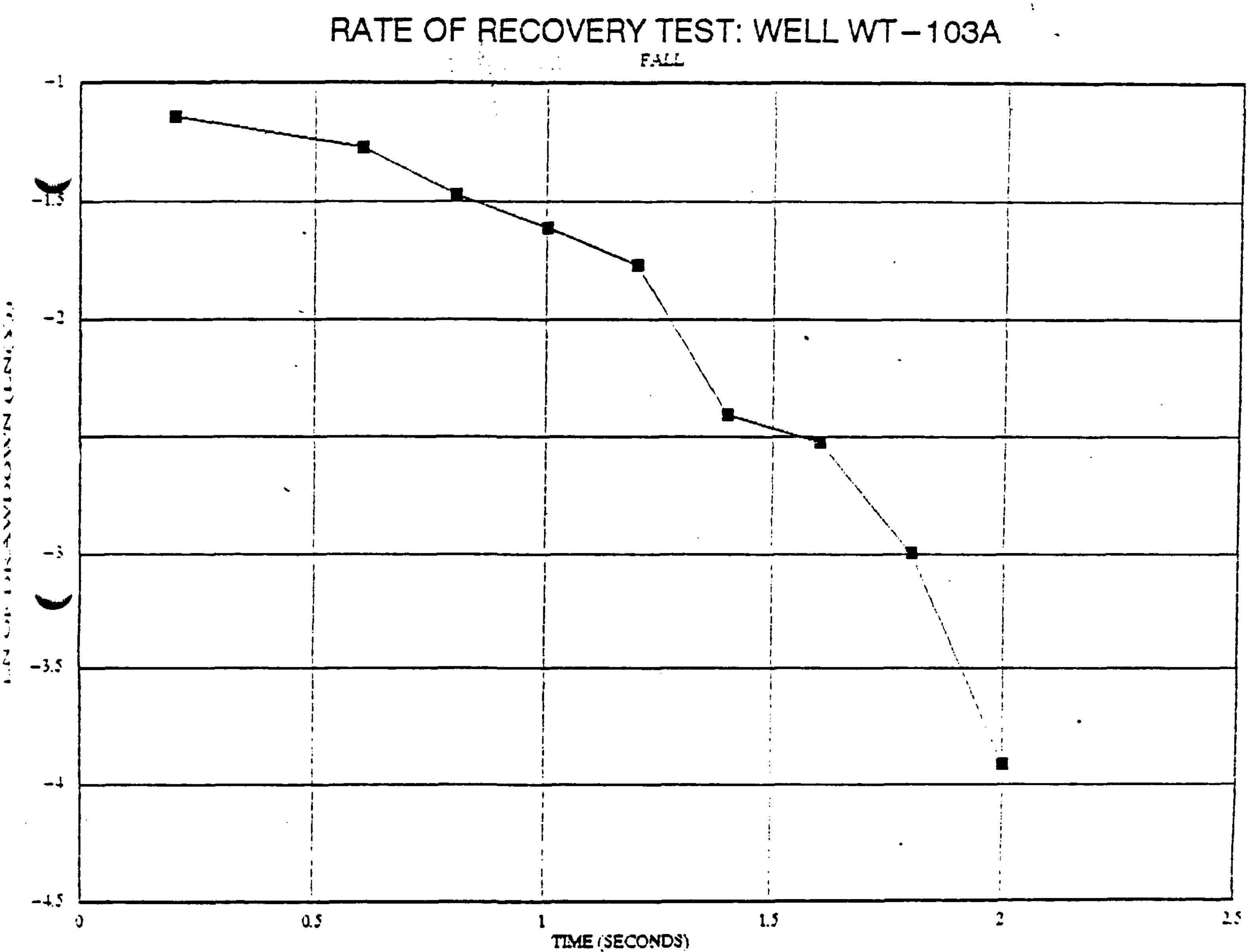
EFFECTIVE r sub c (for sandpack dewatering) = 0.0833
(1/T)(LN(Yo/Yt)) (SLOPE) = -5.92E-01 sec^(-1)

HYDRAULIC CONDUCTIVITY (K) = 6.10E-04 ft/sec
1.86E-02 cm/sec

t=0.2-1s

Regression Output:

Constant	-4.89E-01
Std Err of Y Est	0.0590
R Squared	0.9464
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	-5.92E-01
Std Err of Coef.	0.0997



RATE OF RECOVERY TEST: WELL WT-103A
FALL
-1
-1.5
-2
-3
-3.5
-4
-4.5
0
0.5
1
1.5
2
2.5
TIME (SECONDS)

SOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
TO UTILIZE THIS WORKSHEET, ENTER YOUR DATA AT LOCATIONS MARKED BY AN "I".
PROGRAM CAN INCLUDE EFFECTS OF SANDPACK DEWATERING (ASSUMING WATER IS RISING WITHIN THE SANDPACK).

#	TIME min (X)	DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (X')	LN (Y)
1		7.53	[illegible]	0.00	[illegible]
2		7.55	[illegible]	0.20	[illegible]
3		[illegible]	[illegible]	0.40	[illegible]
4		[illegible]	[illegible]	0.60	[illegible]
5		7.78	0.290	0.80	-1.2379
6		7.86	[illegible]	1.00	[illegible]
7		7.91	0.120	1.20	-2.1203
8		7.96	0.070	4.00	-2.6593
9		7.97	0.020	5.00	-3.9120
10		7.98	0.010	23.00	-4.6052
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IPROJECT NAME : HUNCO
IPROJECT NO : 2002a.024
IWELL NO : MT-[illegible] RISE
IANALYST : [illegible]
IDATE COLLECTED : December 14, 1990
IRISER PIPE I.D.: (r sub c) = [illegible] in. = [illegible] (radius in Ft.)
IEFFECTIVE SCREEN DIAMETER: (r sub w) = [illegible] in. = [illegible] (radius in Ft.)
IEFFECTIVE SCREEN LENGTH: (L) = [illegible] Ft.
IMAX DRAWDOWN (IN SUBSET): (Ymax) = [illegible] Ft.
ISTATIC WATER LEVEL: (SWL) = 7.98 Ft.
IDEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = [illegible].46 Ft.
IEST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = [illegible] Ft.
IINCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 0
ISANDPACK'S SPECIFIC YIELD (Sy) = 0.10

SOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 19.38
---LOG OF L/(r sub w) = 1.2874
FOR PARTIALLY PENETRATING WELLS--
A = 2.07
B = 0.30
FOR FULLY PENETRATING WELLS--
C = 1.30

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.3711
CONST.2 = 2.8685 *(MAX. OF 6.0)* 2.8685
LN(Re/(r sub w)) = 1.92

EFFECTIVE r sub c (for sandpack dewatering) = 0.0833
(1/T)(LN(Yo/Yt)) (SLOPE) = -1.31E+00 sec^(-1)

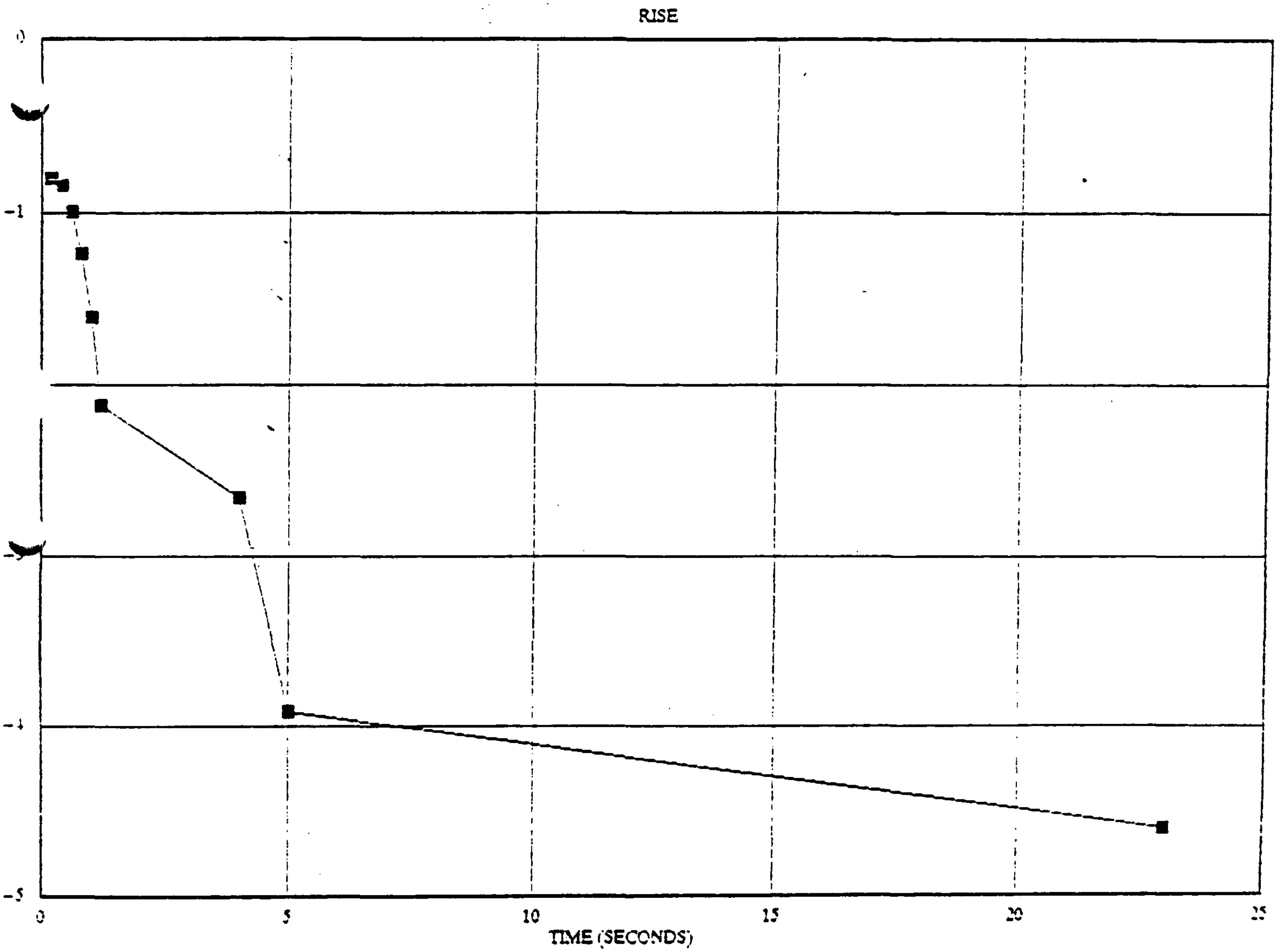
HYDRAULIC CONDUCTIVITY (K) = 1.35E-03 ft/sec <==========
4.10E-02 cm/sec <==========

t=.2-1.25

Regression Output:

Constant	-1.53E-01
Std Err of Y Est	0.1756
R Squared	0.9063
No. of Observations	6
Degrees of Freedom	4
X Coefficient(s)	-1.31E+00
Std Err of Coef.	0.2098

RATE OF RECOVERY TEST: WELL WT −103A



BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
TO UTILIZE THIS WORKSHEET, ENTER YOUR DATA AT LOCATIONS MARKED BY AN "#".
PROGRAM CAN INCLUDE EFFECTS OF SANDPACK DEWATERING (ASSUMING WATER IS RISING WITHIN THE SANDPACK).

#	#TIME min	#DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (T)	LN (Y)
1		5.74	2.730	0.00	1.0047
2		7.12	1.110	0.50	0.1044
3		6.26	0.250	1.00	-1.3863
4		6.17	0.160	2.00	-1.8326
5		6.16	0.150	2.20	-1.8971
6		6.14	0.130	3.00	-2.0402
7		6.13	0.120	3.40	-2.1203
8		6.12	0.110	4.00	-2.2073
9		6.10	0.090	6.00	-2.4079
10		6.09	0.080	7.00	-2.5257
11		6.08	0.070	8.00	-2.6593
12		6.07	0.060	10.00	-2.8134
13		6.06	0.050	12.00	-2.9957
14		6.05	0.040	18.00	-3.2189
15		6.04	0.030	22.00	-3.5066
16		6.03	0.020	32.00	-3.9120
17		6.02	0.010	6.40E+01	-4.6052
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#PROJECT NAME : UNIMCO
#PROJECT NO : 10026.024
#WELL NO : MT1044 FALL
#ANALYST : HELINE
#DATE COLLECTED : 11-14-94
#RISER PIPE (ID): (2 r sub c) = 2.0 in. = 0.0833 (radius in ft.)
#EFFECTIVE SCREEN DIAMETER: (2 r sub w) = 8.0 in. = 0.3333 (radius in ft.)
#EFFECTIVE SCREEN LENGTH: (L) = 12.67 Ft.
#MAX DRAWDOWN (IN SUBSET): (Ymax) = -1.96 Ft.
#STATIC WATER LEVEL: (SWL) = 6.01 Ft.
#DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 12.67 Ft.
#EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 175.00 Ft.
#INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 1
#SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 38.01
---LOG OF L/(r sub w) = 1.5799
FOR PARTIALLY PENETRATING WELLS---
A = 2.71
B = 0.37
FOR FULLY PENETRATING WELLS---
C = 2.16

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.3024
CONST.2 = 6.1882 =(MAX. OF 6.0)= 6.0000
LN(Re/(r sub w)) = 2.31

EFFECTIVE r sub c (for sandpack dewatering) = 0.1318
(1/T)(LN(Yo/Yt)) (SLOPE) = -1.05E-01 sec^(-1)

HYDRAULIC CONDUCTIVITY (K) = 1.66E-04 ft/sec (==================
5.07E-03 cm/sec (==================

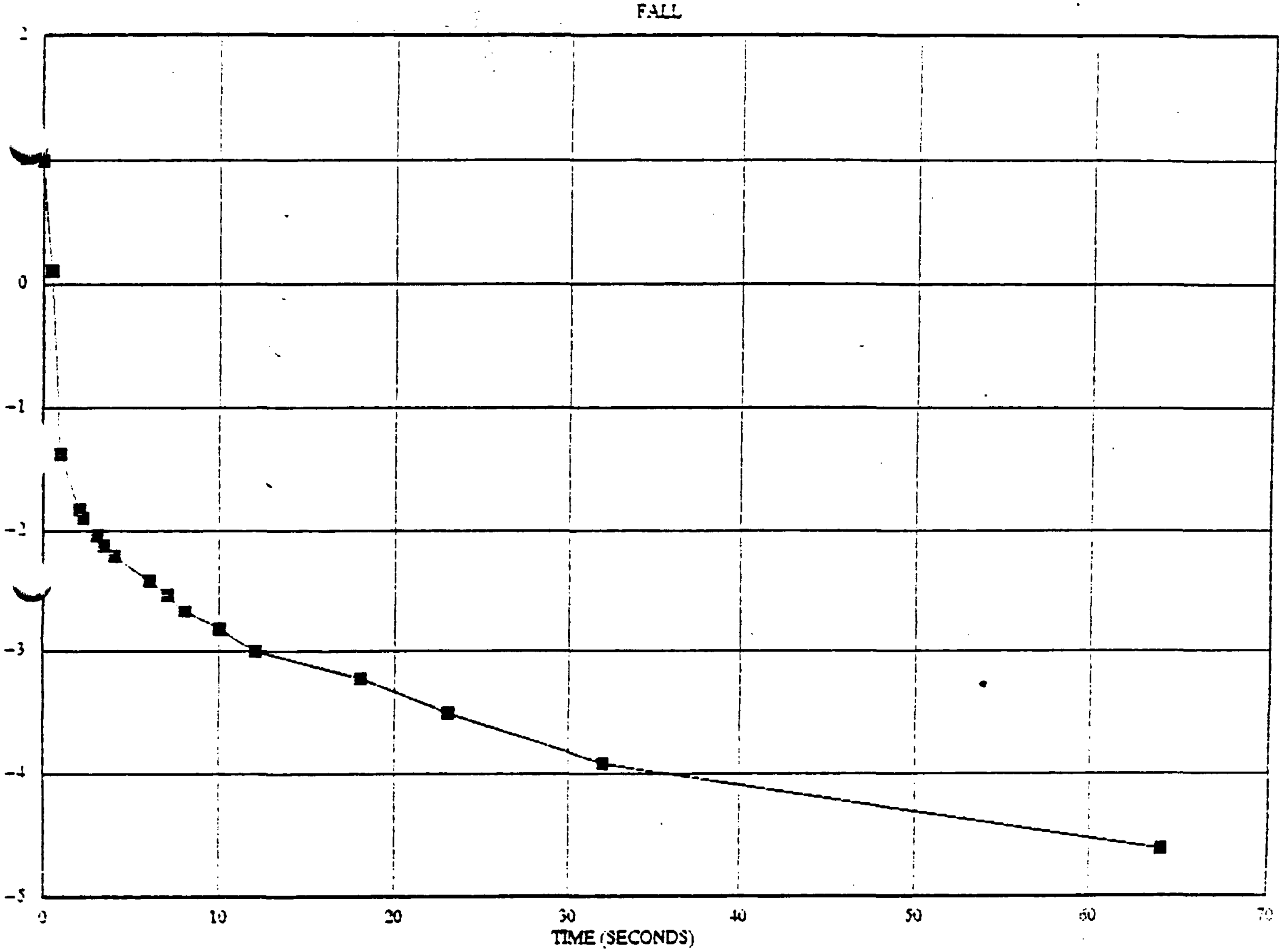
t=3-12 s

Regression Output:

Constant	-1.77E+00
Std Err of Y Est	0.0329
R Squared	0.9920
No. of Observations	8
Degrees of Freedom	6
X Coefficient(s)	-1.05E-01
Std Err of Coef.	0.0038

RATE OF RECOVERY TEST: WELL WT-104A

FALL



BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
TO UTILIZE THIS WORKSHEET, ENTER YOUR DATA AT LOCATIONS MARKED BY AN "*".
PROGRAM CAN INCLUDE EFFECTS OF SANDPACK DEWATERING (ASSUMING WATER IS RISING WITHIN THE SANDPACK).

#	TIME min (T)	DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (T)	LN (Y)
1		5.02	1.010	0.00	-4.6052
2		5.18	0.830	2.00	-0.1863
3		5.31	0.700	2.60	-0.3567
4		5.44	0.570	2.80	-0.5621
5		5.55	0.460	3.00	-0.7765
6		5.65	0.360	3.20	-1.0217
7		5.72	0.290	3.40	-1.2379
8		5.73	0.280	3.60	-1.2730
9		5.77	0.240	3.80	-1.4271
10		5.81	0.200	4.00	-1.6094
11		5.84	0.170	4.20	-1.7720
12		5.86	0.150	4.40	-1.8971
13		5.87	0.140	4.60	-1.9661
14		5.88	0.130	4.80	-2.0402
15		5.90	0.110	5.00	-2.2073
16		5.91	0.100	5.60	-2.3026
17		5.92	0.090	5.80	-2.4079
18		5.93	0.080	6.00	-2.5257
19		5.94	0.070	7.00	-2.6593
20		5.95	0.060	7.80	-2.8134
21		5.96	0.050	8.00	-2.9957
22		5.97	0.040	11.00	-3.2189
23		5.98	0.030	12.00	-3.5066
24		5.99	0.020	15.00	-3.9120
25		6.00	0.010	23.00	-4.6052
26		6.01	0.000	39.00	ERR
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*PROJECT NAME :HIMCO
*PROJECT NO : 20628.024
*WELL NO :WT-104A RISE
*ANALYST :ELIAS
*DATE COLLECTED :12-14-90
*RISER PIPE (ID): (2 r sub c) = 2.0 in. = 0.0833 (radius in ft.)
*EFFECTIVE SCREEN DIAMETER:(2 r sub w) = 8.0 in. = 0.3333 (radius in ft.)
*EFFECTIVE SCREEN LENGTH: (L) = 12.67 Ft.
*MAX DRAWDOWN (IN SUBSET): (Ymax) = 0.70 Ft.
*STATIC WATER LEVEL: (SWL) = 6.01 Ft.
*DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 12.67 Ft.
*EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 175.00 Ft.
*INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 1
*SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 38.01
---LOG OF L/(r sub w) = 1.5799
FOR PARTIALLY PENETRATING WELLS--
A = 2.71
B = 0.37
FOR FULLY PENETRATING WELLS--
C = 2.16

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.3024
CONST.2 = 6.1882 =(MAX. OF 6.0)= 6.0000
LN(Re/(r sub w)) = 2.31

EFFECTIVE r sub c (for sandpack dewatering) = 0.1318
(1/T)(LN(Yo/Yt)) (SLOPE) = -8.06E-01 sec^(-1)

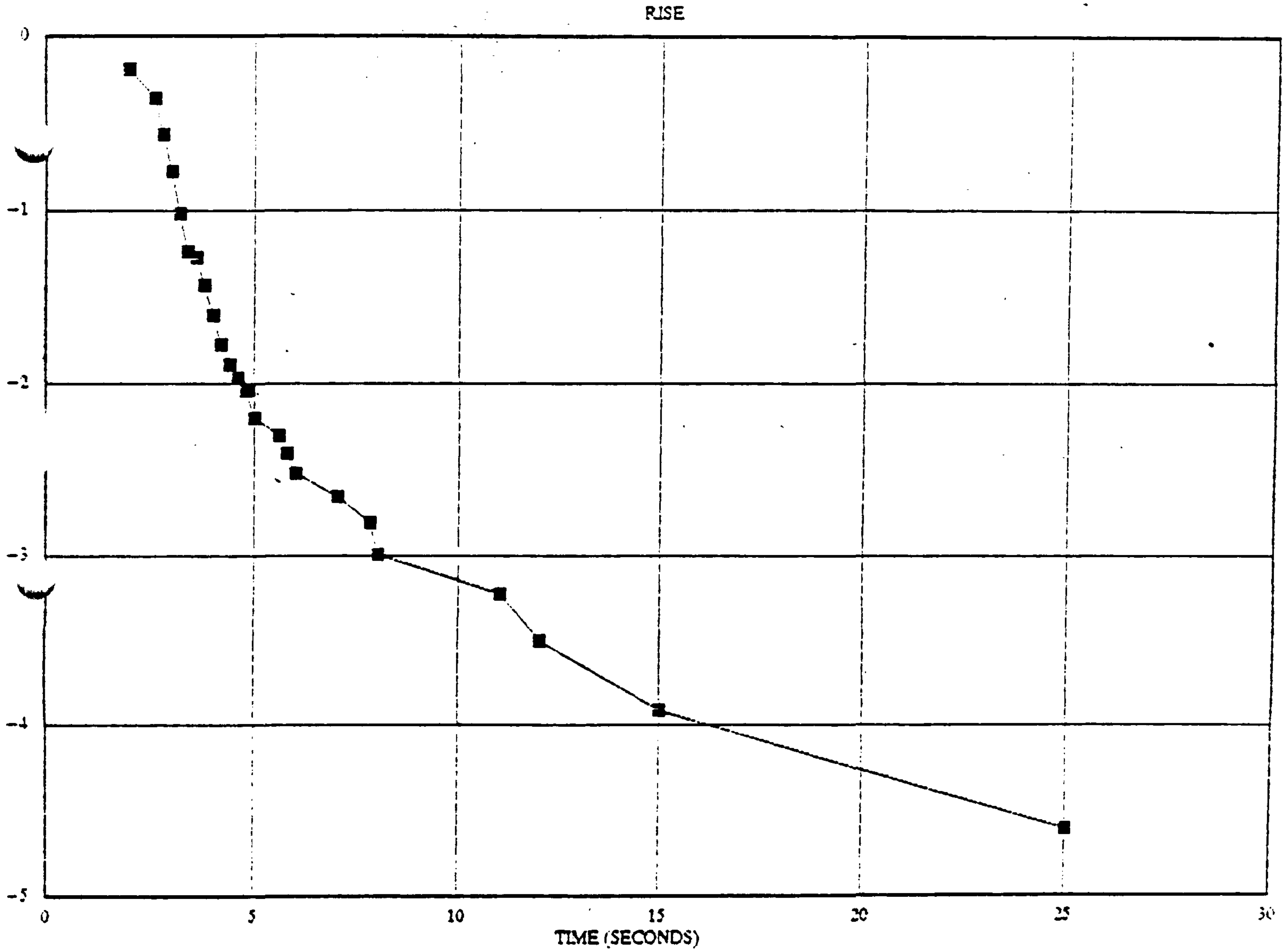
HYDRAULIC CONDUCTIVITY (K) = 1.28E-03 ft/sec (******************
3.89E-02 cm/sec (******************

t=2.6-4.6 s

Regression Output:

Constant	1.64E+00
Std Err of Y Est	0.0748
R Squared	0.9827
No. of Observations	11
Degrees of Freedom	9
X Coefficient(s)	-8.06E-01
Std Err of Coef.	0.0256

RATE OF RECOVERY TEST: WELL WT−104A



BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
TO UTILIZE THIS WORKSHEET, ENTER YOUR DATA AT LOCATIONS MARKED BY AN "#".
PROGRAM CAN INCLUDE EFFECTS OF SANDPACK DEWATERING (ASSUMING WATER IS RISING WITHIN THE SANDPACK).

#	#TIME min (X)	DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (T)	LN (Y)
1		8.96	0.980	0.00	[illegible]
2		8.42	0.440	0.20	[illegible]
3		8.13	0.150	1.40	-1.8971
4		8.12	0.140	1.60	-1.9661
5		8.11	0.130	1.80	-2.0402
6		8.10	0.120	2.40	-2.1203
7		8.09	0.110	2.60	-2.2073
8		8.08	0.100	3.40	-2.3026
9		8.07	0.090	3.60	-2.4079
10		8.06	0.080	4.40	-2.5257
11		8.05	0.070	5.40	-2.6593
12		8.04	0.060	6.40	-2.8134
13		8.03	0.050	8.60	-2.9957
14		8.02	0.040	12.40	-3.2189
15		8.01	0.030	18.40	-3.5066
16		8.00	0.020	27.00	[illegible]
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#PROJECT NAME : HIMCO
#PROJECT NO : 2013a.024
#WELL NO : MW-105A FALL
#ANALYST : ELIAS
#DATE COLLECTED : 12-14-90
#RISER PIPE (ID): (2 * sub c) = 2.0 in. = 0.0833 (radius in ft.)
#EFFECTIVE SCREEN DIAMETER: (2 * sub w) = 8.0 in. = 0.3333 (radius in ft.)
#EFFECTIVE SCREEN LENGTH: (L) = 10.08 Ft.
#MAX DRAWDOWN (IN SUBSET): (ymax) = -0.13 Ft.
#STATIC WATER LEVEL: (SWL) = 7.98 Ft.
#DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 10.08 Ft.
#EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = -175.00 Ft.
#INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 1
#SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 30.24
---LOG OF L/(r sub w) = 1.4806
FOR PARTIALLY PENETRATING WELLS--
A = 2.45
B = 0.34
FOR FULLY PENETRATING WELLS--
C = 1.86

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.2227
CONST.2 = 6.2041 =(MAX. OF 6.0)= 6.0000
LN(Re/(r sub w)) = 2.13

EFFECTIVE r sub c (for sandpack dewatering) = 0.1318
(1/T)*LN(Yo/Yt)) (SLOPE) = -1.81E-01 sec^(-1)

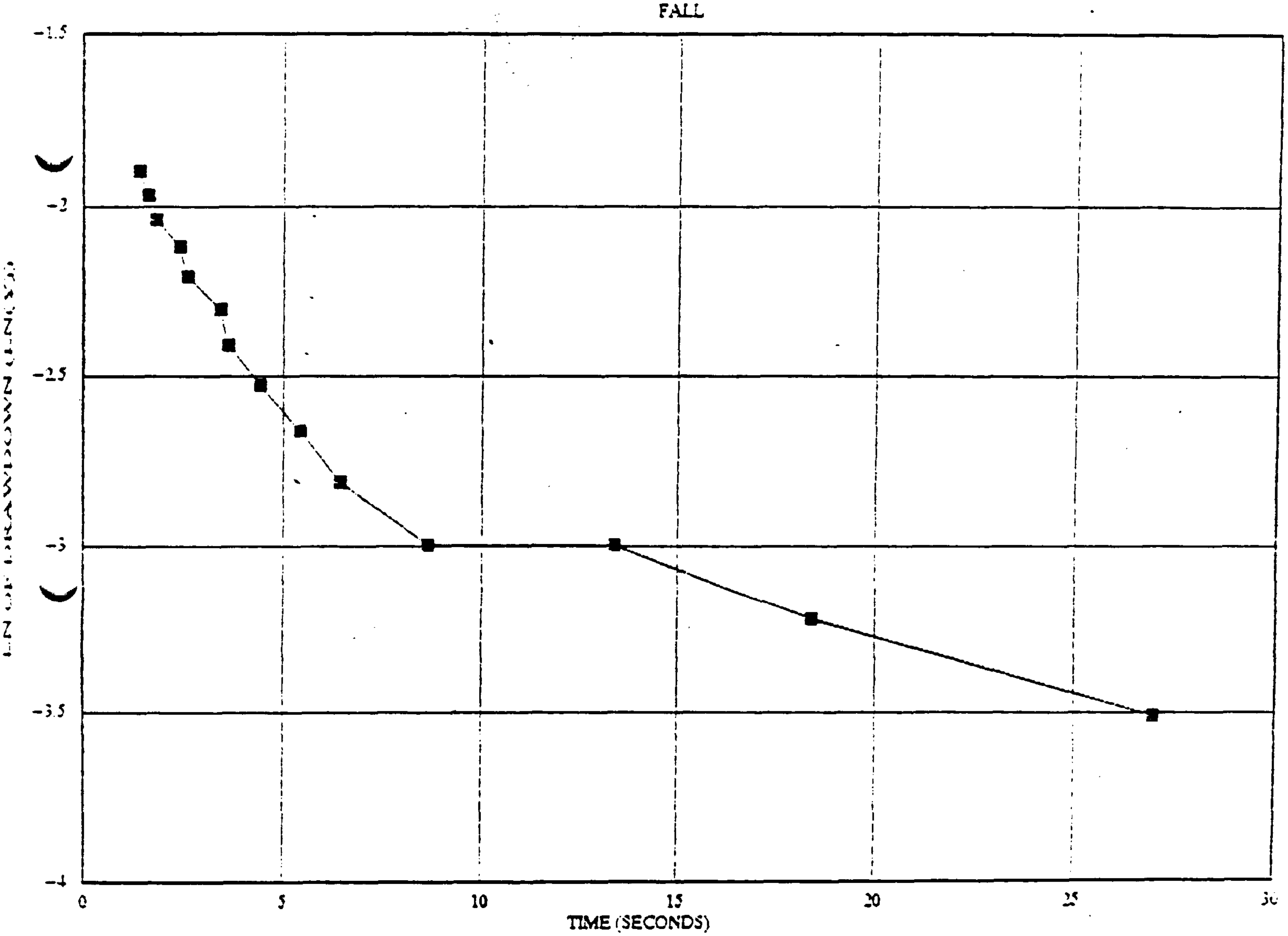
HYDRAULIC CONDUCTIVITY (K) = 3.32E-04 ft/sec
1.01E-02 cm/sec

t=2.6-4.4 s

Regression Output:

Constant	-1.72E+00
Std Err of Y Est	0.0237
R Squared	0.9544
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	-1.81E-01
Std Err of Coef.	0.0279

RATE OF RECOVERY TEST: WELL WT-105A



BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
TO UTILIZE THIS WORKSHEET, ENTER YOUR DATA AT LOCATIONS MARKED BY AN "#".
PROGRAM CAN INCLUDE EFFECTS OF SANDPACK DEWATERING (ASSUMING WATER IS RISING WITHIN THE SANDPACK).

#	#TIME min (X)	#DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (X')	LN (Y)
1		6.82	1.160	0.00	0.1484
2		7.03	0.950	0.80	-0.0513
3		7.26	0.720	1.00	-0.3285
4		7.39	0.590	1.20	-0.5276
5		7.51	0.470	1.40	-0.7550
6		7.60	0.380	1.60	-0.9676
7		7.67	0.310	1.80	-1.1712
8		7.73	0.250	2.00	-1.3863
9		7.79	0.190	2.20	-1.6607
10		7.82	0.160	2.40	-1.8326
11		7.84	0.140	2.60	-1.9661
12		7.85	0.130	2.80	-2.0402
13		7.87	0.110	3.00	-2.2073
14		7.88	0.100	3.20	-2.3026
15		7.89	0.090	3.40	-2.4079
16		7.90	0.080	3.60	-2.5257
17		7.91	0.070	3.80	-2.6593
18		7.93	0.050	5.00	-2.9957
19		7.94	0.040	7.00	-3.2189
20		7.95	0.030	9.00	-3.5066
21		7.96	0.020	12.00	-3.9120
22		7.97	0.010	19.00	-4.6052
23		7.98	0.000	22.00	ERR
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#PROJECT NAME :MINCO
#PROJECT NO : 2002a.024
#WELL NO :WT-105A RISE
#ANALYST :ELIAS
#DATE COLLECTED :12-14-90
#RISER PIPE (ID): (2 * sub c) = 2.0 in. = 0.0833 (radius in ft.)
#EFFECTIVE SCREEN DIAMETER:(2 r sub w) = 8.0 in. = 0.3333 (radius in ft.)
#EFFECTIVE SCREEN LENGTH: (L) = 10.00 Ft.
#MAX DRAWDOWN (IN SUBSET): (Ymax) = 0.95 Ft.
#STATIC WATER LEVEL: (SWL) = 7.98 Ft.
#DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 10.00 Ft.
#EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 175.00 Ft.
#INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 0
#SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 30.24
---LOG OF L/(r sub w) = 1.4806
FOR PARTIALLY PENETRATING WELLS--
A = 2.45
B = 0.34
FOR FULLY PENETRATING WELLS--
C = 1.86

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.3227
CONST.2 = 6.2041 =(MAX. OF 6.0)= 6.0000
LN(Re/(r sub w) = 2.13

EFFECTIVE r sub c (for sandpack dewatering) = 0.0833
(1/T)(LN(Yo/Yt)) (SLOPE) = -8.62E-01 sec^(-1)

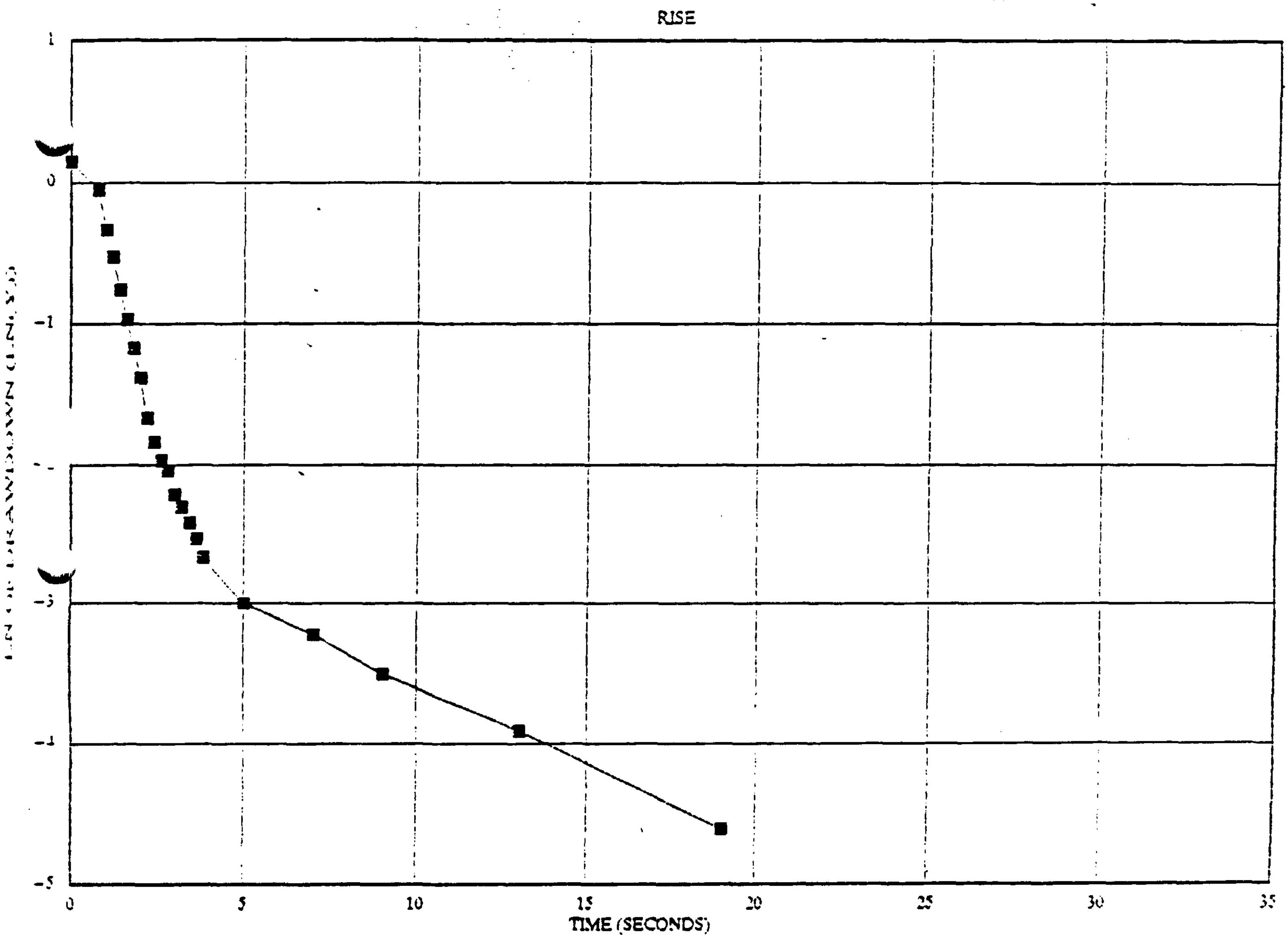
HYDRAULIC CONDUCTIVITY (K) = 6.32E-04 ft/sec <==================
1.93E-02 cm/sec <==================

t = 2.2-3.8 s

Regression Output:

Constant	4.33E-01
Std Err of Y Est	0.1316
R Squared	0.9766
No. of Observations	16
Degrees of Freedom	14
X Coefficient(s)	-8.62E-01
Std Err of Coef.	0.0357

RATE OF RECOVERY TEST: WELL WT−105A



BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.
TO UTILIZE THIS WORKSHEET, ENTER YOUR DATA AT LOCATIONS MARKED BY AN "#".
PROGRAM CAN INCLUDE EFFECTS OF SANDPACK DEWATERING (ASSUMING WATER IS RISING WITHIN THE SANDPACK).

#	TIME min (T)	DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (X')	LN (Y)
1		9.02	0.000	0.00	ERR
2		9.96	0.940	1.00	-0.0619
3		9.80	0.780	1.40	-0.2485
4		9.32	0.300	1.60	-1.2040
5		9.24	0.220	1.80	-1.5141
6		9.10	0.080	2.00	-2.5257
7		9.07	0.050	2.80	-2.9957
8		9.06	0.040	3.00	-3.2189
9		9.05	0.030	4.00	-3.5066
10		9.04	0.020	7.00	-3.9120
11					
12					
13					
14					
15					
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24					
25					
26					
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31					
32					
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40					
41					
42					
43					

#PROJECT NAME :HIMCO
#PROJECT NO : 20026.024
#WELL NO :WT-10eA FALL
#ANALYST, :ELIAS
#DATE COLLECTED :12-1-90
#RISER PIPE (ID): (2 r sub c) = 2.0 in. = 0.0833 (radius in ft.)
#EFFECTIVE SCREEN DIAMETER: (2 r sub w) = 8.0 in. = 0.3333 (radius in ft.)
#EFFECTIVE SCREEN LENGTH: (L) = 9.25 Ft.
#MAX DRAWDOWN (IN SUBSET): (max) = -.78 Ft.
#STATIC WATER LEVEL: (SWL) = 9.02 Ft.
#DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 9.25 Ft.
#EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 175.00 Ft.
#INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 0
#SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 27.75
---LOG OF L/(r sub w) = 1.4433
FOR PARTIALLY PENETRATING WELLS---
A = 2.26
B = 0.32
FOR FULLY PENETRATING WELLS---
C = 1.77

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.2310
CONST.2 = 6.2091 =(MAX. OF 6.0)= 6.0000
LN(Re/(r sub w) = 2.06

EFFECTIVE r sub c (for sandpack dewatering) = 0.0833
(1/T)(LN(Yo/Yt)) (SLOPE) = -3.57E+00 sec^(-1)

HYDRAULIC CONDUCTIVITY (K) = 2.76E-03 ft/sec <==========
8.40E-02 cm/sec <==========

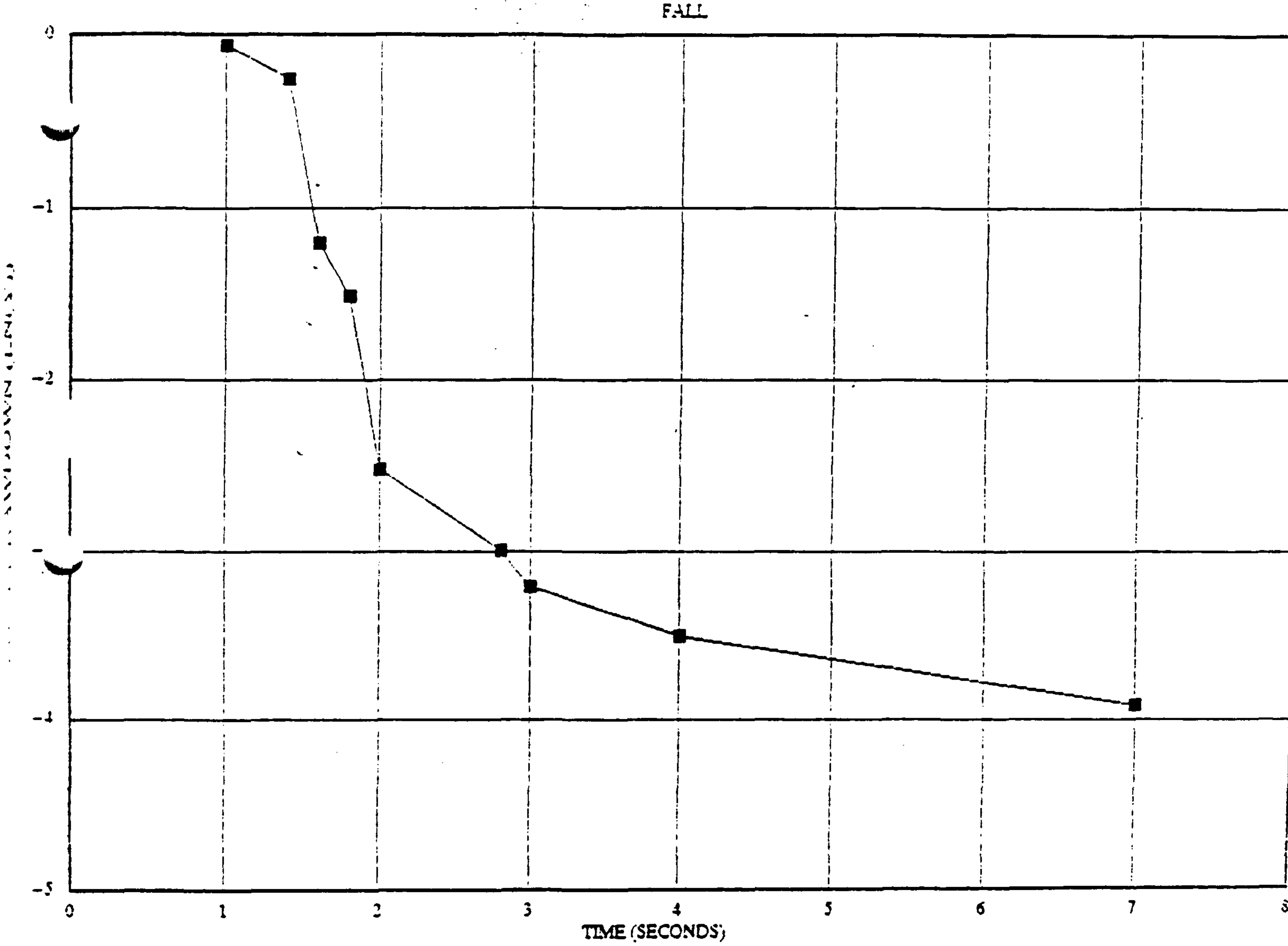
t=1.4-2.0 s

Regression Output:

Constant	4.70E+00
Std Err of Y Est	0.2139
R Squared	0.9654
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	-3.57E+00
Std Err of Coef.	0.4782

RATE OF RECOVERY TEST: WELL WT-106A

FALL



BOUWER AND RICE METHOD FOR INTERPRETATION OF SLUG TESTS: FOR UNCONFINED AND LEAKY CONFINED AQUIFERS.

TO UTILIZE THIS WORKSHEET, ENTER YOUR DATA AT LOCATIONS MARKED BY AN "#".

PROGRAM CAN INCLUDE EFFECTS OF SANDPACK DEWATERING (ASSUMING WATER IS RISING WITHIN THE SANDPACK).

#	TIME min (t)	DEPTH TO WATER Ft.	DRAWDOWN (Y)	TIME sec (X)	LN (Y)
1		8.49	0.540	0.00	-0.6162
2		8.58	0.440	0.20	-0.8210
3		8.60	0.420	1.00	-0.8675
4		8.69	0.330	1.40	-1.1087
5		8.79	0.230	1.60	-1.4697
6		8.86	0.160	1.80	-1.8326
7		8.92	0.100	2.00	-2.3026
8		8.95	0.070	2.20	-2.6593
9		8.97	0.050	2.40	-2.9957
10		8.99	0.030	2.60	-3.5066
11		9.00	0.020	2.80	-3.9120
12		9.01	0.010	14.00	-4.6052
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					

#PROJECT NAME :HIRCO
#PROJECT NO : 20026.024
#WELL NO :MW-106A [redacted]
#ANALYST :ELIAS
#DATE COLLECTED :12-1-90
#RISER PIPE (ID): (2 r sub c) = 2.0 in. = 0.0833 (radius in Ft.)
#EFFECTIVE SCREEN DIAMETER: (2 r sub w) = 8.0 in. = 0.3333 (radius in Ft.)
#EFFECTIVE SCREEN LENGTH: (L) = 9.25 Ft.
#MAX DRAWDOWN (IN SUBSET): (Ymax) = 0.54 Ft.
#STATIC WATER LEVEL: (SWL) = 9.02 Ft.
#DEPTH FROM SWL TO EFF. SCREEN BOTTOM: (H) = 9.25 Ft.
#EST. AQUIFER DEPTH (SWL TO AQUIFER BOTTOM): (D) = 175.00 Ft.
#INCLUDE SANDPACK DEWATERING (ENTER 1 IF YES, 0 IF NO)? 0
#SANDPACK'S SPECIFIC YIELD (Sy) = 0.10

BOUWER AND RICE CURVE COEFFICIENTS:
RATIO OF L/(r sub w) = 27.75
---LOG OF L/(r sub w) = 1.4433
FOR PARTIALLY PENETRATING WELLS--
A = 2.36
B = 0.32
FOR FULLY PENETRATING WELLS--
C = 1.77

---EVALUATION OF LN(Re/(r sub w)):
CONST.1 = 0.2310
CONST.2 = 6.2091 =(MAX. OF 6.0)= 6.0000
LN(Re/(r sub w)) = 2.06

EFFECTIVE r sub c (for sandpack dewatering) = 0.0833
(1/T)(LN(Yo/Yt)) (SLOPE) = -2.00E+00 sec^(-1)

HYDRAULIC CONDUCTIVITY (K) = 1.55E-03 ft/sec <==================
4.71E-02 cm/sec <==================

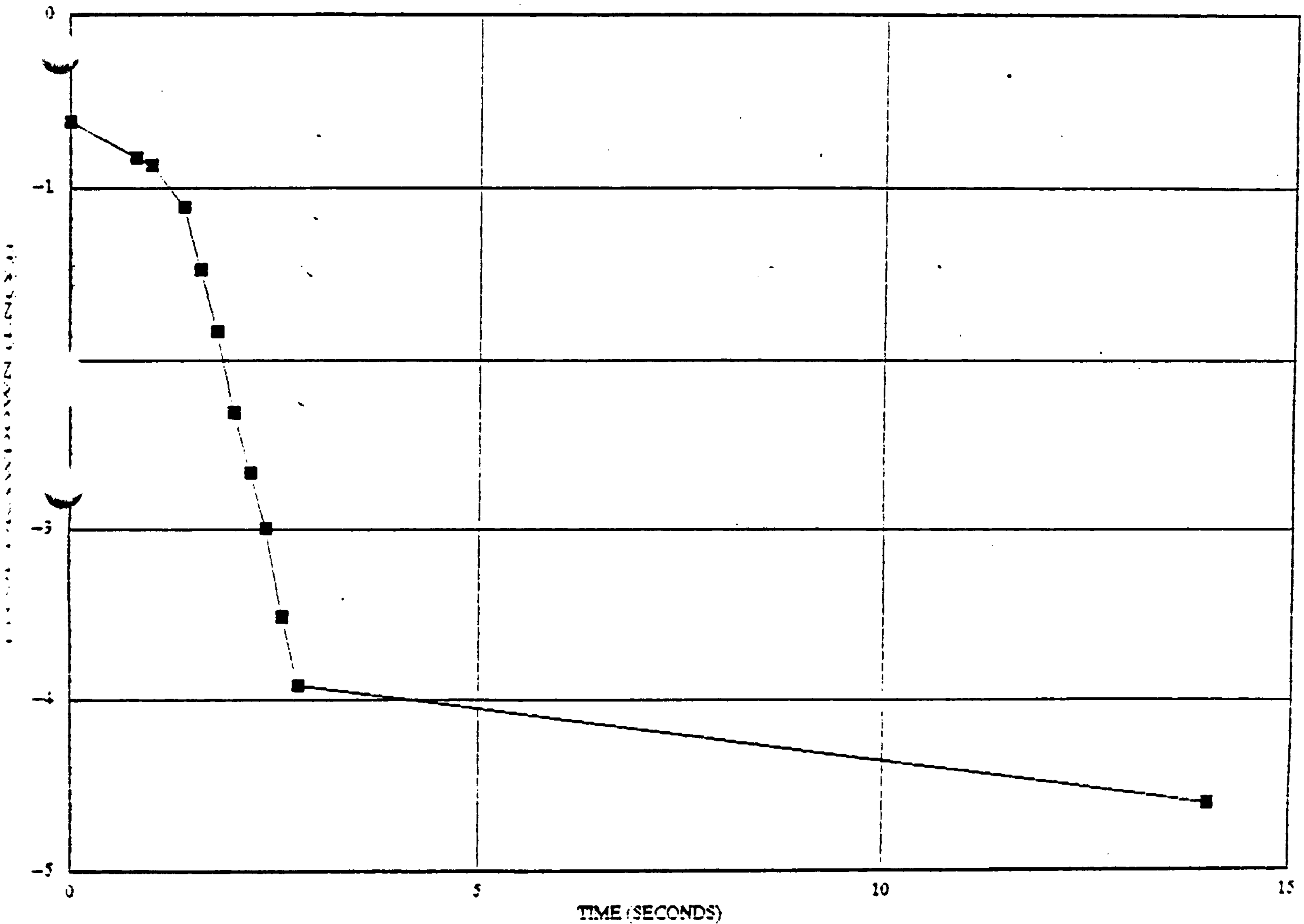
t=1.4-2.8 s

Regression Output:

Constant	1.73E+00
Std Err of Y Est	0.0458
R Squared	0.9981
No. of Observations	8
Degrees of Freedom	6
X Coefficient(s)	-2.00E+00
Std Err of Coef.	0.0333

RATE OF RECOVERY TEST: WELL WT-106A

RISE



APPENDIX B

SLUG TEST FIELD FORMS

Donohue ENGINEERS ARCHITECTS SCIENTISTS

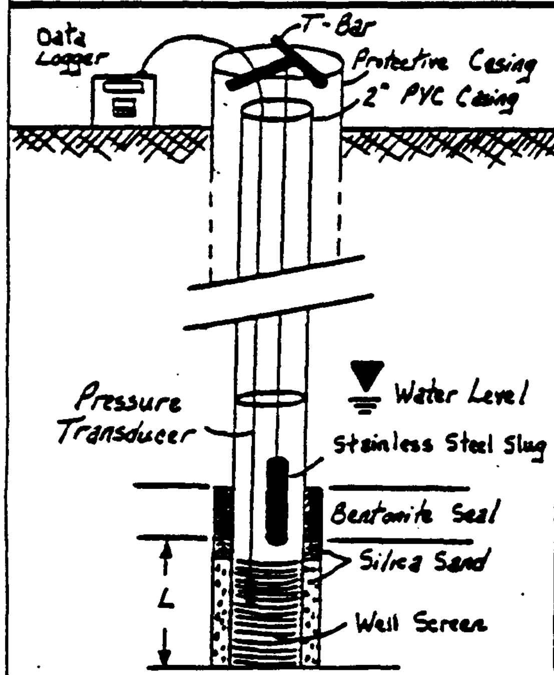
INFIELD HYDRAULIC CONDUCTIVITY SLUG TEST

SHEET 1 OF 1

PROJECT NO.: 20026 023
SITE: HIMCO DUMP
WELL NUMBER: P102B
LOGGER ID NUMBER: 04

CLIENT: USEPA
WELL DRILLED BY: John Mathes & Assoc
DATE TEST PERFORMED: Jan 4, 1991
TIME TEST PERFORMED: 1300
TOP OF PIPE ELEVATION:
OBSERVATION WELL/PIEZOMETER (circle):
FALL/RISE TEST (circle) BOTH
FORMATION WELL SCREENED IN: OUTWASH
STATIC WATER LEVEL (T.C.P.): 8.87

TOTAL DEPTH OF WELL: 67.33'
DEPTH OF WATER IN WELL: 58.44'
INITIAL TRANSDUCER WATER LEVEL: 4.76
STATIC TRANSDUCER WATER LEVEL:
DIAMETER OF BOREHOLE: 8"
DIAMETER OF PIPE: 2"
SCREEN LENGTH: 5 feet
EFFECTIVE SCREEN LENGTH* "L": 9 feet



*"L" length is less than the sand pack length if the water table intersects sand pack, where "L" will equal distance between water table and bottom of sand pack.

SILOG II LOGGING SEQUENCE

SEGMENT NUMBER	NUMBER OF READINGS	INTERVAL (SEC.)	SEGMENT DURATION (SEC.)	ELAPSED TIME (SEC.)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

PRESSURE TRANSDUCER PSI:
STAINLESS STEEL SLUG LENGTH:

NOTES:

TEST PERFORMED BY: Tom PUCHALSKI
DATE: Jan. 4 1991
LOGGER DOWNLOADED BY: [illegible]
DATE: 1/14/91
CALCULATIONS BY: [illegible]
DATE:
COMPUTER FILE NAME: [illegible]

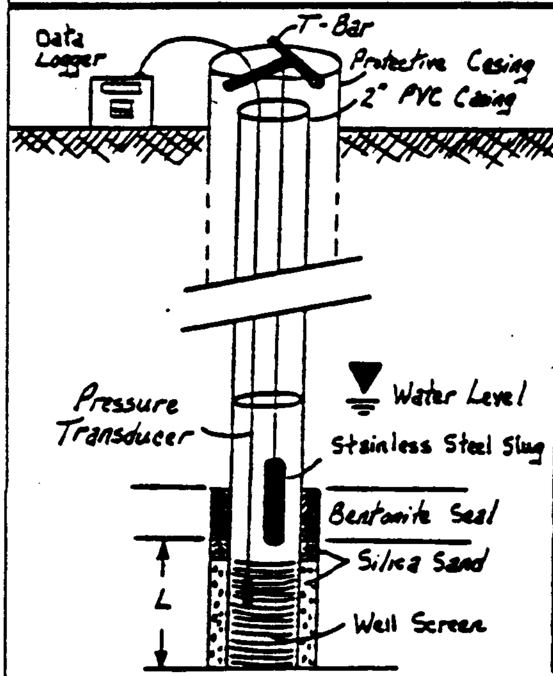
INFIELD HYDRAULIC CONDUCTIVITY SLUG TEST

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SHEET 1 OF 1

PROJECT NO.: 20026.023
WELL NUMBER: P101B
SITE: HIMCO DUMP
LOGGER ID NUMBER: 02

CLIENT: USEPA
TOTAL DEPTH OF WELL: 100.57
WELL DRILLED BY: John Mathes & Assoc, Inc.
DEPTH OF WATER IN WELL: 91.00
DATE TEST PERFORMED: 1/4/91
INITIAL TRANSDUCER WATER LEVEL: 10.46
TIME TEST PERFORMED: 1140
STATIC TRANSDUCER WATER LEVEL:
TOP OF PIPE ELEVATION:
DIAMETER OF BOREHOLE: 8"
OBSERVATION WELL/PIEZOMETER (circle):
DIAMETER OF PIPE: 2"
FALL/RISE TEST (circle)
SCREEN LENGTH: 5'
FORMATION WELL SCREENED IN: Outwash
EFFECTIVE SCREEN LENGTH* "L": 5'
STATIC WATER LEVEL (T.C.P.): 9.05



*"L" length is less than the sand pack length if the water table intersects sand pack, where "L" will equal distance between water table and bottom of sand pack.

SILOG II LOGGING SEQUENCE

SEGMENT NUMBER	NUMBER OF READINGS	INTERVAL (SEC.)	SEGMENT DURATION (SEC.)	ELAPSED TIME (SEC.)
1	25	1/5	5	5
2	25	1	25	30
3	10	2	~~30~~ 20	~~80~~ 50
4	30	5	150	200
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

PRESSURE TRANSDUCER PSI: 5
STAINLESS STEEL SLUG LENGTH: 4 feet

NOTES:

TEST PERFORMED BY: TOM PUCHALSKI
DATE: 1/4/91
LOGGER DOWNLOADED BY: [illegible]
DATE: 1/4/91
CALCULATIONS BY: [illegible]
DATE:
COMPUTER FILE NAME: [illegible]

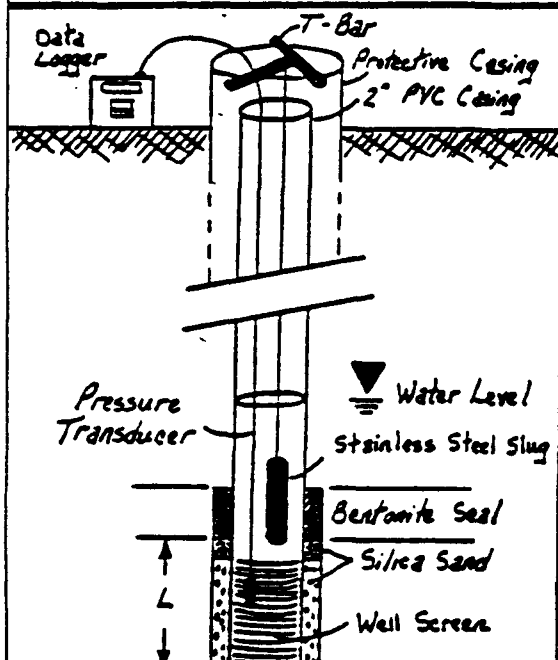
Donohue ENGINEERS ARCHITECTS SCIENTISTS

INFIELD HYDRAULIC CONDUCTIVITY SLUG TEST

SHEET 1 OF 1

PROJECT NO.: 20036.023
WELL NUMBER: P101C
SITE: HIMCO DUMP
LOGGER ID NUMBER: 01

CLIENT: USEPA
TOTAL DEPTH OF WELL: 102.07'
WELL DRILLED BY: John Mathes & Assoc, Inc.
DEPTH OF WATER IN WELL: ~~9.33'~~ 9.57'
DATE TEST PERFORMED: 1/14/91
INITIAL TRANSDUCER WATER LEVEL: 9.55
TIME TEST PERFORMED: 1040
STATIC TRANSDUCER WATER LEVEL: 10.88
TOP OF PIPE ELEVATION:
DIAMETER OF BOREHOLE: 8 inches
OBSERVATION WELL/PIEZOMETER (circle):
DIAMETER OF PIPE: 2 inches
FALL/RISE TEST (circle)
SCREEN LENGTH: 5 feet
FORMATION WELL SCREENED IN: Outwash SP
EFFECTIVE SCREEN LENGTH* "L": 5 feet
STATIC WATER LEVEL (T.C.P.):



SILOG II LOGGING SEQUENCE

SEGMENT NUMBER	NUMBER OF READINGS	INTERVAL (SEC.)	SEGMENT DURATION (SEC.)	ELAPSED TIME (SEC.)
1	5	1/5		1
2	5	1/5		2
3				3
4				4
5				5
6				6
7				7
8				8
9				9
10				10
11	25	1/5	5	5
12	25	1	25	30
13	10	2	20	50
14	30	5	150	200
15				
16				

*"L" length is less than the sand pack length if the water table intersects sand pack, where "L" will equal distance between water table and bottom of sand pack.

PRESSURE TRANSDUCER PSI: 5
STAINLESS STEEL SLUG LENGTH: 4

NOTES: Rerun test at 1241 Station 03 transducer static 9.98
11.43 - static start rising test - Poor test

TEST PERFORMED BY: TOM PUCHALSKI
DATE: 1/14/91
LOGGER DOWNLOADED BY: CEX
DATE: 1/14/91
CALCULATIONS BY: CE
DATE:
COMPUTER FILE NAME: P101C R
F

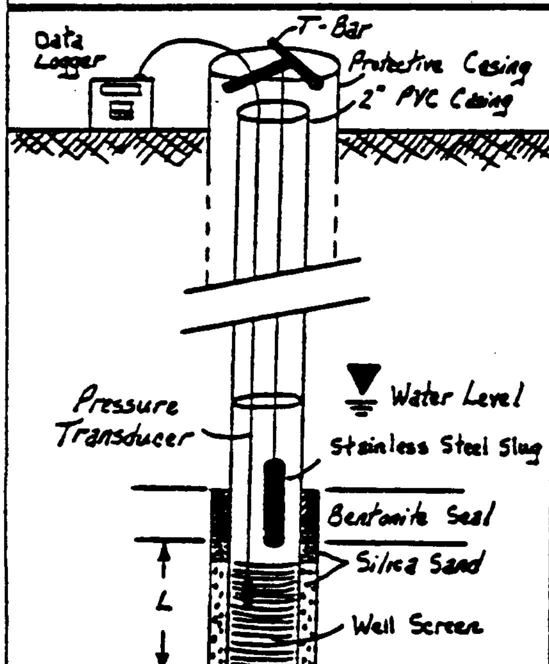
INFIELD HYDRAULIC CONDUCTIVITY SLUG TEST

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SHEET ____ OF ____

PROJECT NO.: 20026.023
WELL NUMBER: E-3
SITE: Himco
LOGGER ID NUMBER: 719C21

CLIENT: USEPA
TOTAL DEPTH OF WELL: 175.58'
WELL DRILLED BY:
DEPTH OF WATER IN WELL: 11.60'
DATE TEST PERFORMED: 12-14-90
INITIAL TRANSDUCER WATER LEVEL: 7.96'
TIME TEST PERFORMED: 11:15
STATIC TRANSDUCER WATER LEVEL: 7.96'
TOP OF PIPE ELEVATION:
DIAMETER OF BOREHOLE:
OBSERVATION WELL/PIEZOMETER (circle):
DIAMETER OF PIPE: 5" ID
FALL/RISE TEST (circle) Both
SCREEN LENGTH:
FORMATION WELL SCREENED IN:
EFFECTIVE SCREEN LENGTH* "L":
STATIC WATER LEVEL (T.C.P.):



*"L" length is less than the sand pack length if the water table intersects sand pack, where "L" will equal distance between water table and bottom of sand pack.

SILOG II LOGGING SEQUENCE

SEGMENT NUMBER	NUMBER OF READINGS	INTERVAL (SEC.)	SEGMENT DURATION (SEC.)	ELAPSED TIME (SEC.)	
1	50	0.2	10	10	F.H.
2	15	1	15	15	
3	15	5	75	75	
4	15	30	450	450	
5					
6					
~~7~~ 1	50	0.2	10	10	
~~8~~ 2	15	1	15	15	R.H.
~~9~~ 3	15	5	75	75	
~~10~~ 4	15	30	450	450	
11					
12					
13					
14					
15					
16					

PRESSURE TRANSDUCER PSI: 15
STAINLESS STEEL SLUG LENGTH: 4'

NOTES: Identified as S3

TEST PERFORMED BY: T. Krach / F. Slusser
DATE: 12-14-90
LOGGER DOWNLOADED BY: T Krach
DATE: 12-14-90
CALCULATIONS BY:
DATE:
COMPUTER FILE NAME:

INFIELD HYDRAULIC CONDUCTIVITY SLUG TEST

SHEET 1 OF 1

Donohue Engineers Architects Scientists

PROJECT NO.: 20020.023

WELL NUMBER: F-2

SITE: HIMCO

LOGGER ID NUMBER: 719021

CLIENT: EPA

TOTAL DEPTH OF WELL: > 15.0'

WELL DRILLED BY:

DEPTH OF WATER IN WELL: 13.95

DATE TEST PERFORMED: 12-2-90

INITIAL TRANSDUCER WATER LEVEL:

TIME TEST PERFORMED: 0950

STATIC TRANSDUCER WATER LEVEL: 10.06'

TOP OF PIPE ELEVATION:

DIAMETER OF BOREHOLE:

OBSERVATION WELL/PIEZOMETER (circle):

DIAMETER OF PIPE: 5"

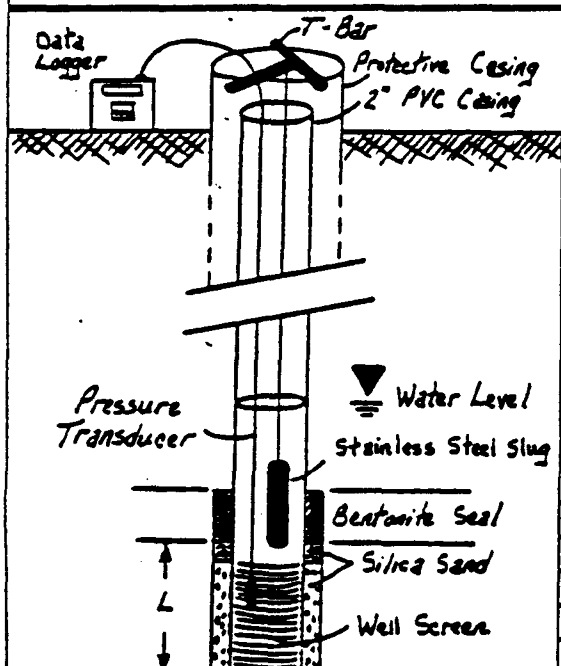
FALL/RISE TEST (circle) Both

SCREEN LENGTH:

FORMATION WELL SCREENED IN:

EFFECTIVE SCREEN LENGTH* "L":

STATIC WATER LEVEL (T.C.P.):



*"L" length is less than the sand pack length if the water table intersects sand pack, where "L" will equal distance between water table and bottom of sand pack.

SILOG II LOGGING SEQUENCE

SEGMENT NUMBER	NUMBER OF READINGS	INTERVAL (SEC.)	SEGMENT DURATION (SEC.)	ELAPSED TIME (SEC.)
1	50	0.2	10	10
2	15	1	15	15
3	15	5	75	75
4	15	30	450	450
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

PRESSURE TRANSDUCER PSI: 15

STAINLESS STEEL SLUG LENGTH: 4'

NOTES: Identified AS 02

TEST PERFORMED BY: C. Feldke, T. Keach DATE: 12-2-90

LOGGER DOWNLOADED BY: C. Feldke DATE: 12-2-90

CALCULATIONS BY: DATE:

COMPUTER FILE NAME:

Donohue ENGINEERS ARCHITECTS SCIENTISTS

INFIELD HYDRAULIC CONDUCTIVITY SLUG TEST

SHEET ____ OF ____

PROJECT NO.: 20026 023

SITE: HIMCO

WELL NUMBER: F-1

LOGGER ID NUMBER: 719021

CLIENT: EPA

WELL DRILLED BY:

DATE TEST PERFORMED: 12-2-90

TIME TEST PERFORMED: 0915

TOP OF PIPE ELEVATION:

OBSERVATION WELL/PIEZOMETER (circle):

FALL/RISE TEST (circle) Both

FORMATION WELL SCREENED IN:

STATIC WATER LEVEL (T.C.P.):

TOTAL DEPTH OF WELL: 31.3'

DEPTH OF WATER IN WELL: 8.45'

INITIAL TRANSDUCER WATER LEVEL:

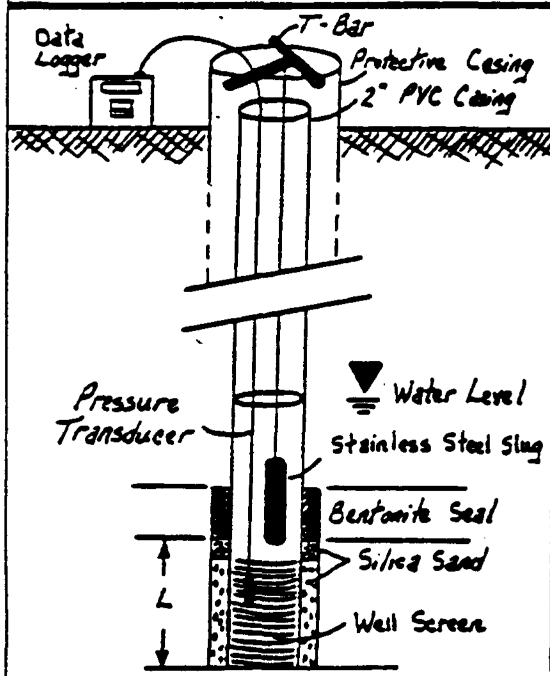
STATIC TRANSDUCER WATER LEVEL: 10.05'

DIAMETER OF BOREHOLE:

DIAMETER OF PIPE: 2"

SCREEN LENGTH:

EFFECTIVE SCREEN LENGTH* "L":



*"L" length is less than the sand pack length if the water table intersects sand pack, where "L" will equal distance between water table and bottom of sand pack.

SILOG II LOGGING SEQUENCE

SEGMENT NUMBER	NUMBER OF READINGS	INTERVAL (SEC.)	SEGMENT DURATION (SEC.)	ELAPSED TIME (SEC.)
1	50	0.2	10	10
2	15	1	30	30
3	15	2	30	30
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

PRESSURE TRANSDUCER PSI: 15

STAINLESS STEEL SLUG LENGTH: 4'

NOTES: Identified as 01
- Well Not Locked

TEST PERFORMED BY: C. Friedl, T. Krack

DATE: 12-2-90

LOGGER DOWNLOADED BY:

DATE:

CALCULATIONS BY:

DATE:

COMPUTER FILE NAME:

Donohue Engineers Architects Scientists

INFIELD HYDRAULIC CONDUCTIVITY SLUG TEST

SHEET 1 OF 1

PROJECT NO.: 20026 .23

WELL NUMBER: M-1

SITE: HIMCO

LOGGER ID NUMBER: 717021

CLIENT: EPA

TOTAL DEPTH OF WELL: 104.50'

WELL DRILLED BY:

DEPTH OF WATER IN WELL: 16.10'

DATE TEST PERFORMED: 12-2-90

INITIAL TRANSDUCER WATER LEVEL:

TIME TEST PERFORMED: 1130

STATIC TRANSDUCER WATER LEVEL: 9.98'

TOP OF PIPE ELEVATION:

DIAMETER OF BOREHOLE:

CF ~~OBSERVATION WELL~~/PIEZOMETER (circle):

DIAMETER OF PIPE: 2"

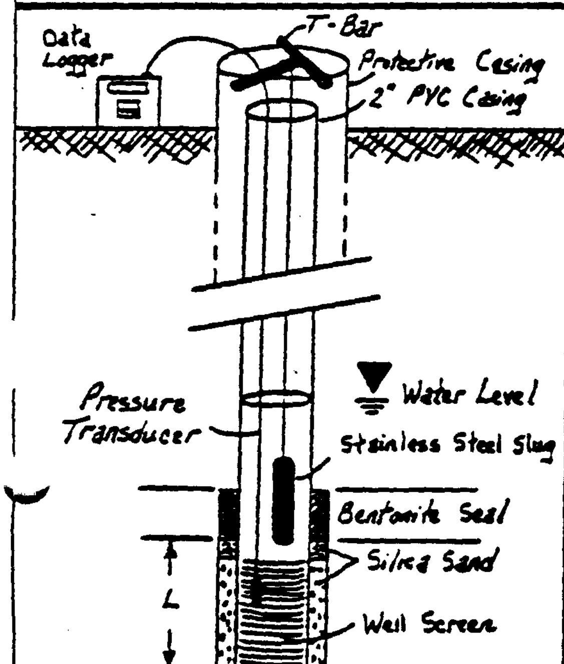
FALL/RISE TEST (circle) Both

SCREEN LENGTH:

FORMATION WELL SCREENED IN:

EFFECTIVE SCREEN LENGTH* "L":

STATIC WATER LEVEL (T.C.P.):



*"L" length is less than the sand pack length if the water table intersects sand pack, where "L" will equal distance between water table and bottom of sand pack.

SILOG II LOGGING SEQUENCE

SEGMENT NUMBER	NUMBER OF READINGS	INTERVAL (SEC.)	SEGMENT DURATION (SEC.)	ELAPSED TIME (SEC.)	
1	50	0.2	10	10	Falling Head
2	15	1	15	15	
3	15	5	75	75	
4	15	30	450	~~[illegible]~~	CF
5					
~~6~~ 1	50	0.2	10	10	rising Head
~~7~~ 2	15	1	15	15	
~~8~~ 3	15 CF	2	30	30	
~~9 4~~	~~15 30~~	~~16~~	~~[illegible]~~	~~5~~	
~~10~~ 4	6	10	60	60	
11					
12					
13					
14					
15					
16					

PRESSURE TRANSDUCER PSI: 15

STAINLESS STEEL SLUG LENGTH: 4'

NOTES: Falling Head test Stopped - Returned to static before segment 4 was Completed

Station ID #3

TEST PERFORMED BY: C Fowler & T. Krack

DATE: 12-2-90

LOGGER DOWNLOADED BY:

DATE:

CALCULATIONS BY:

DATE:

COMPUTER FILE NAME:

INFIELD HYDRAULIC CONDUCTIVITY SLUG TEST

Donohue Engineers Architects Scientists

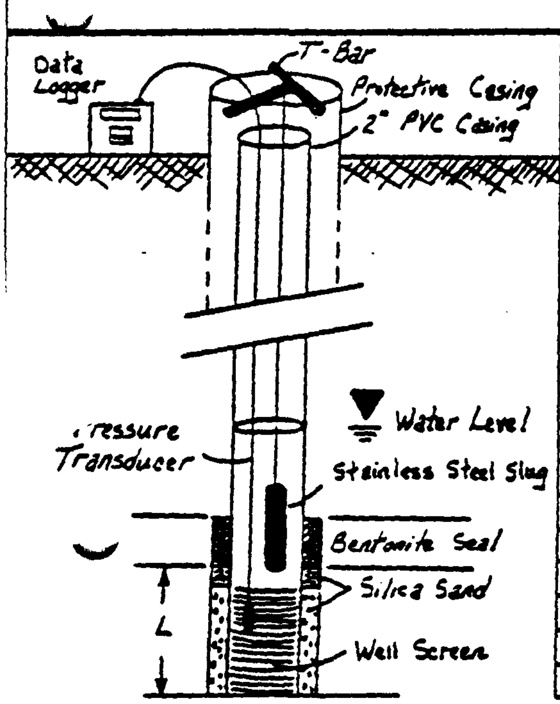
SHEET ____ OF ____

PROJECT NO.: 20026.023
HIMCO

WELL NUMBER: M-2
LOGGER ID NUMBER: 719021

CLIENT: EPA
WELL DRILLED BY:
DATE TEST PERFORMED: ~~12-2-90~~ 12-2-90
TIME TEST PERFORMED: ~~1135~~
TOP OF PIPE ELEVATION:
OBSERVATION WELL/PIEZOMETER (circle):
FALL/RISE TEST (circle) Both
FORMATION WELL SCREENED IN:
STATIC WATER LEVEL (T.C.P.):

TOTAL DEPTH OF WELL: 24.80'
DEPTH OF WATER IN WELL: 15.25'
INITIAL TRANSDUCER WATER LEVEL:
STATIC TRANSDUCER WATER LEVEL: 8.03'
DIAMETER OF BOREHOLE:
DIAMETER OF PIPE: 2"
SCREEN LENGTH:
EFFECTIVE SCREEN LENGTH* "L":



SILOG II LOGGING SEQUENCE

SEGMENT NUMBER	NUMBER OF READINGS	INTERVAL (SEC.)	SEGMENT DURATION (SEC.)	ELAPSED TIME (SEC.)
1				
2				
3				
4				
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13				
14				
15				
16				

*"L" length is less than the sand pack length if the water table intersects sand pack, where "L" will equal distance between water table and bottom of sand pack.

PRESSURE TRANSDUCER PSI:
STAINLESS STEEL SLUG LENGTH:

NOTES: Station ID # 4
Obstruction at ~16' slug could not go down well - Redone on 12-14-90 with 2' slug; form attached

TEST PERFORMED BY: C Ferrell, T Kosck DATE: 12-2-90
LOGGER DOWNLOADED BY: DATE:
CALCULATIONS BY: DATE:
COMPUTER FILE NAME:

INFIELD HYDRAULIC CONDUCTIVITY SLUG TEST

Donohue — Engineers, Architects, Scientists

SHEET ____ OF ____

PROJECT NO.: 20026.023 WELL NUMBER: M-2

SITE: Hunco LOGGER ID NUMBER: 719021

CLIENT: ____ TOTAL DEPTH OF WELL: 24.80

WELL DRILLED BY: ____ DEPTH OF WATER IN WELL: 15.27

DATE TEST PERFORMED: 12-14-90 INITIAL TRANSDUCER WATER LEVEL: ____

TIME TEST PERFORMED: ____ STATIC TRANSDUCER WATER LEVEL: 7.01

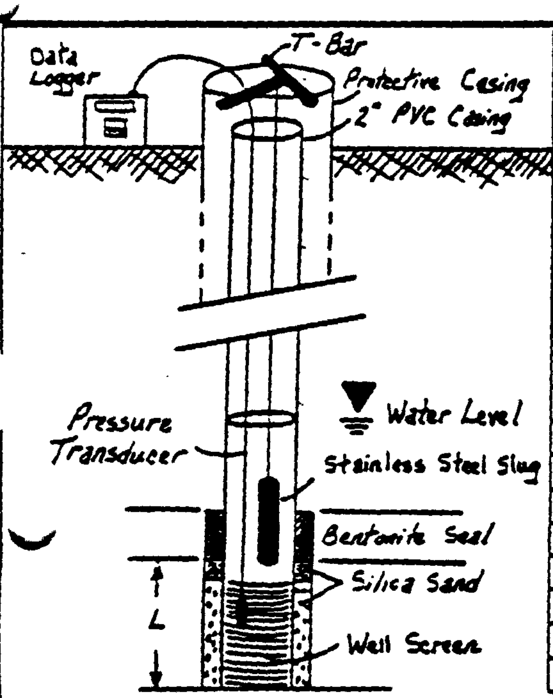
TOP OF PIPE ELEVATION: ____ DIAMETER OF BOREHOLE: ____

OBSERVATION WELL/PIEZOMETER (circle): ____ DIAMETER OF PIPE: 2"

FALL/RISE TEST (circle) ____ SCREEN LENGTH: ____

FORMATION WELL SCREENED IN: ____ EFFECTIVE SCREEN LENGTH* "L": ____

STATIC WATER LEVEL (T.C.P.): ____



*"L" length is less than the sand pack length if the water table intersects sand pack, where "L" will equal distance between water table and bottom of sand pack.

SILOG II LOGGING SEQUENCE

SEGMENT NUMBER	NUMBER OF READINGS	INTERVAL (SEC.)	SEGMENT DURATION (SEC.)	ELAPSED TIME (SEC.)	
1	50	0.2	10	10	
2	15	1	15	15	F.H.
3	15	5	75	75	
4	15	30	450	450	
5					
~~6~~ 1	50	0.2	10	10	
~~7~~ 2	15	1	15	15	R.H
~~8~~ 3	15	5	75	75	
~~9~~ 4	15	30	450	450	
10					
11					
12					
13					
14					
15					
16					

PRESSURE TRANSDUCER PSI: 15

STAINLESS STEEL SLUG LENGTH: 2'

NOTES: Indicated @ 33

TEST PERFORMED BY: T. Krach; E. Slusser DATE: 12-14-90

LOGGER DOWNLOADED BY: T. Krach DATE: 12-14-90

CALCULATIONS BY: ____ DATE: ____

COMPUTER FILE NAME: ____

Donohue ENGINEERS ARCHITECTS SCIENTISTS

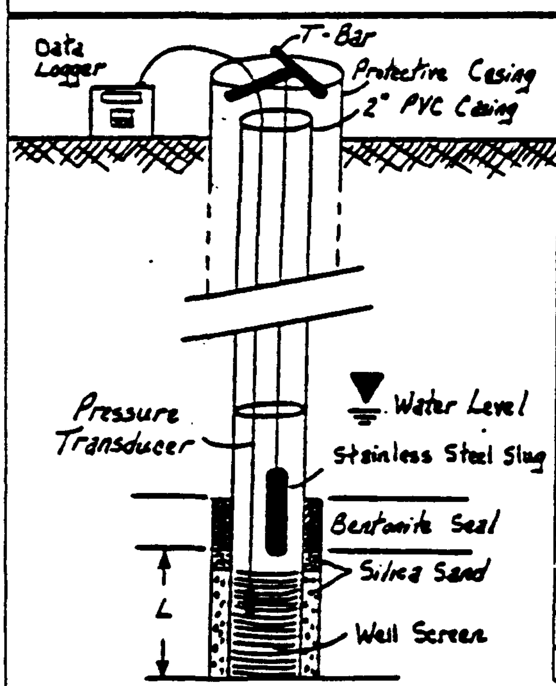
INFIELD HYDRAULIC CONDUCTIVITY SLUG TEST

SHEET 1 OF 1

PROJECT NO.: 20026.023
WELL NUMBER: WT 101A
SITE: HIMCO
LOGGER ID NUMBER: 719021

CLIENT: EPA
WELL DRILLED BY: ~~Donohue~~ Mathes
DATE TEST PERFORMED: 12/1/90
TIME TEST PERFORMED: 1428 + 1430
TOP OF PIPE ELEVATION:
OBSERVATION WELL/PIEZOMETER (circle):
FALL/RISE TEST (circle) Both
FORMATION WELL SCREENED IN:
STATIC WATER LEVEL (T.C.P.): -

TOTAL DEPTH OF WELL: -18.70
DEPTH OF WATER IN WELL: -11.26
INITIAL TRANSDUCER WATER LEVEL:
STATIC TRANSDUCER WATER LEVEL: 7.02'
DIAMETER OF BOREHOLE:
DIAMETER OF PIPE: 2"
SCREEN LENGTH:
EFFECTIVE SCREEN LENGTH* "L":



*"L" length is less than the sand pack length if the water table intersects sand pack, where "L" will equal distance between water table and bottom of sand pack.

SILOG II LOGGING SEQUENCE

SEGMENT NUMBER	NUMBER OF READINGS	INTERVAL (SEC.)	SEGMENT DURATION (SEC.)	ELAPSED TIME (SEC.)
1	50	0.2 seconds	10	10
2	60	1 second	60	60
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

PRESSURE TRANSDUCER PSI: 15
STAINLESS STEEL SLUG LENGTH: 4'

NOTES: Rising + Falling Head tests manually stopped due to very fast recovery

TEST PERFORMED BY: Cathy Frueh DATE: 12/1/90
LOGGER DOWNLOADED BY: Cathy Frueh DATE: 12/1/90
CALCULATIONS BY: DATE:
COMPUTER FILE NAME:

INFIELD HYDRAULIC CONDUCTIVITY SLUG TEST

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SHEET ____ OF ____

PROJECT NO.: 20026.023

WELL NUMBER: WT1C2A

SITE: Himco

LOGGER ID NUMBER: 719021

CLIENT: USEPA

TOTAL DEPTH OF WELL: 18.16

WELL DRILLED BY:

DEPTH OF WATER IN WELL: 10.29'

DATE TEST PERFORMED: 12-14-90

INITIAL TRANSDUCER WATER LEVEL:

TIME TEST PERFORMED: 14:30

STATIC TRANSDUCER WATER LEVEL: 7.01

TOP OF PIPE ELEVATION:

DIAMETER OF BOREHOLE:

OBSERVATION WELL/PIEZOMETER (circle):

DIAMETER OF PIPE: 2"

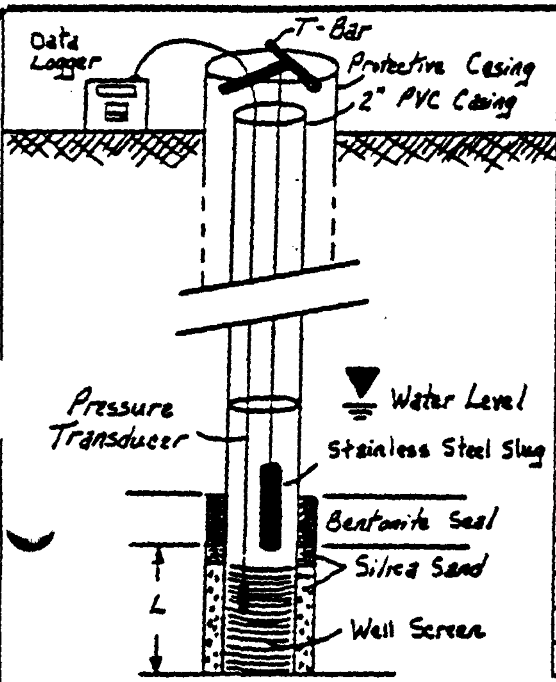
FALL/RISE TEST (circle) BOTH

SCREEN LENGTH:

FORMATION WELL SCREENED IN:

EFFECTIVE SCREEN LENGTH* "L":

STATIC WATER LEVEL (T.C.P.):



*"L" length is less than the sand pack length if the water table intersects sand pack, where "L" will equal distance between water table and bottom of sand pack.

SILOG II LOGGING SEQUENCE

SEGMENT NUMBER	NUMBER OF READINGS	INTERVAL (SEC.)	SEGMENT DURATION (SEC.)	ELAPSED TIME (SEC.)	
1	50	0.2	10	10	F.H.
2	15	1	15	15	
3	15	5	75	75	
4	15	30	450	450	
5					
~~6~~ 1	50	0.2	10	10	R.H
~~7~~ 2	15	1	15	15	
~~8~~ 3	15	5	75	75	
~~9~~ 4	15	30	450	450	
10					
11					
12					
13					
14					
15					
16					

PRESSURE TRANSDUCER PSI: 15#

STAINLESS STEEL SLUG LENGTH: 4'

NOTES: Identified as 12

TEST PERFORMED BY: T Kocel, E. Slusser

DATE: 12-14-90

LOGGER DOWNLOADED BY: T Kocel

DATE: 12-14-90

CALCULATIONS BY:

DATE:

COMPUTER FILE NAME:

Donohue engineers architects scientists

INFIELD HYDRAULIC CONDUCTIVITY SLUG TEST

SHEET ___ OF ___

PROJECT NO.: 20026.023

WELL NUMBER: WT103 A

SITE: Himco

LOGGER ID NUMBER: 719021

CLIENT: USEPA

TOTAL DEPTH OF WELL: 18.48

WELL DRILLED BY:

DEPTH OF WATER IN WELL: 5.46

DATE TEST PERFORMED: 12-14-90

INITIAL TRANSDUCER WATER LEVEL:

TIME TEST PERFORMED: 13:59

STATIC TRANSDUCER WATER LEVEL: 7.98'

TOP OF PIPE ELEVATION:

DIAMETER OF BOREHOLE: 2"

OBSERVATION WELL/PIEZOMETER (circle):

DIAMETER OF PIPE:

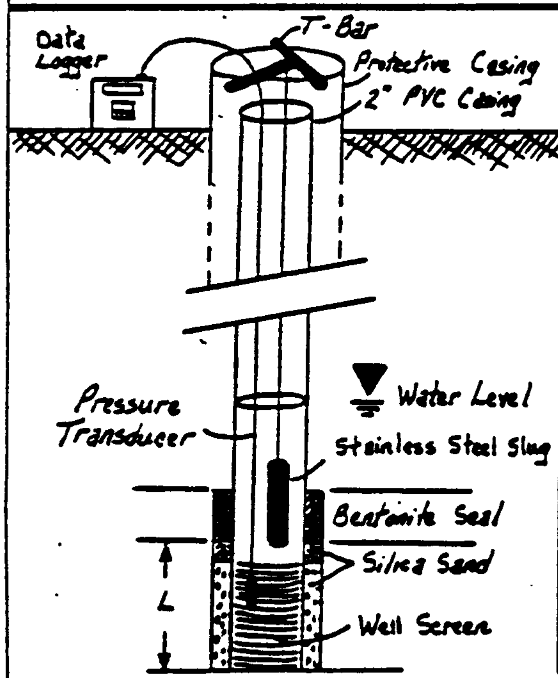
FALL/RISE TEST (circle) BOTH

SCREEN LENGTH:

FORMATION WELL SCREENED IN:

EFFECTIVE SCREEN LENGTH* "L":

STATIC WATER LEVEL (T.C.P.):



*"L" length is less than the sand pack length if the water table intersects sand pack, where "L" will equal distance between water table and bottom of sand pack.

SILOG II LOGGING SEQUENCE

SEGMENT NUMBER	NUMBER OF READINGS	INTERVAL (SEC.)	SEGMENT DURATION (SEC.)	ELAPSED TIME (SEC.)
1	50	0.2	10	10
2	15	1	15	15
3	15	5	75	75
4	15	30	450	450
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

PRESSURE TRANSDUCER PSI: 15

STAINLESS STEEL SLUG LENGTH: 4'

NOTES: Identified as 13

TEST PERFORMED BY: T Roach, E. Shuster

DATE: 12-14-90

LOGGER DOWNLOADED BY: T Roach

DATE: 12-14-90

CALCULATIONS BY:

DATE:

COMPUTER FILE NAME:

INFIELD HYDRAULIC CONDUCTIVITY SLUG TEST

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SHEET ___ OF ___

PROJECT NO.: 20C26.023

WELL NUMBER: WT104A

SITE: Himco

LOGGER ID NUMBER: 719021

CLIENT: US EPA

TOTAL DEPTH OF WELL: [illegible]

WELL DRILLED BY:

DEPTH OF WATER IN WELL: 11.67'

DATE TEST PERFORMED: 12-14-90

INITIAL TRANSDUCER WATER LEVEL:

TIME TEST PERFORMED: 1200

STATIC TRANSDUCER WATER LEVEL: 6.01'

TOP OF PIPE ELEVATION:

DIAMETER OF BOREHOLE:

OBSERVATION WELL/PIEZOMETER (circle):

DIAMETER OF PIPE: 2" [illegible]

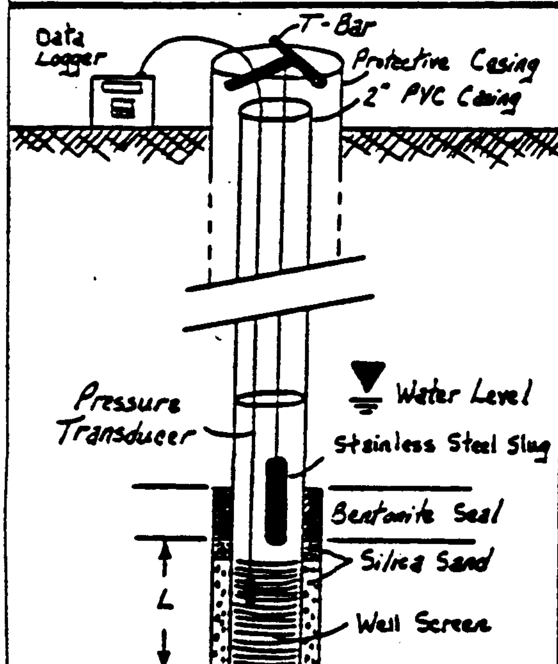
FALL/RISE TEST (circle) Both

SCREEN LENGTH:

FORMATION WELL SCREENED IN:

EFFECTIVE SCREEN LENGTH* "L":

STATIC WATER LEVEL (T.C.P.):



*"L" length is less than the sand pack length if the water table intersects sand pack, where "L" will equal distance between water table and bottom of sand pack.

SILOG II LOGGING SEQUENCE

SEGMENT NUMBER	NUMBER OF READINGS	INTERVAL (SEC.)	SEGMENT DURATION (SEC.)	ELAPSED TIME (SEC.)	
1	50	0.2	10	10	
2	15	1	15	15	F.H.
3	15	5	75	75	
4	15	30	450	450	
5					
~~6~~ 1	50	0.2	10	10	R.H.
~~7~~ 2	15	1	15	15	
~~8~~ 3	15	5	75	75	
~~9~~ 4	15	30	450	450	
10					
11					
12					
13					
14					
15					
16					

PRESSURE TRANSDUCER PSI: 15

STAINLESS STEEL SLUG LENGTH: 4'

NOTES: Identified as 14

TEST PERFORMED BY: T Kosch E. Slusser DATE: 12-14-90

LOGGER DOWNLOADED BY: T Kosch DATE: 12-14-90

CALCULATIONS BY: DATE:

COMPUTER FILE NAME:

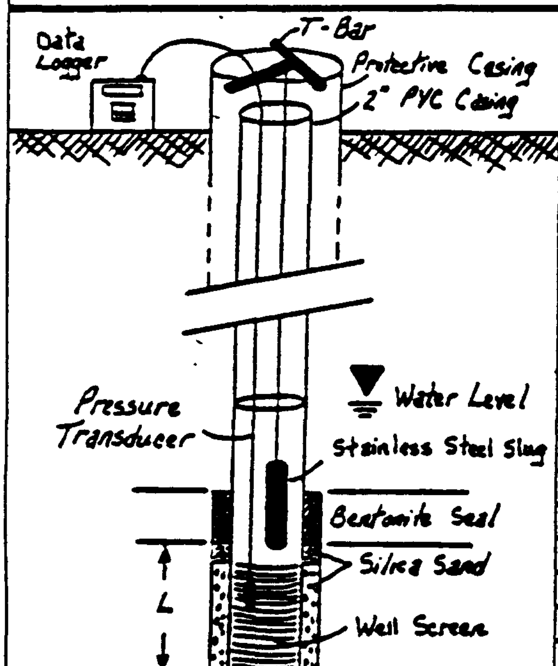
Donohue ENGINEERS ARCHITECTS SCIENTISTS

INFIELD HYDRAULIC CONDUCTIVITY SLUG TEST

SHEET 1 OF 1

PROJECT NO.: 20026.023
WELL NUMBER: WT105A
SITE: HIMCO
LOGGER ID NUMBER: 719021

CLIENT: EPA
TOTAL DEPTH OF WELL: 19.55'
WELL DRILLED BY: Mathes
DEPTH OF WATER IN WELL: 9.28'
DATE TEST PERFORMED: 12-1-90
INITIAL TRANSDUCER WATER LEVEL:
TIME TEST PERFORMED: 1600
STATIC TRANSDUCER WATER LEVEL: 7.98'
TOP OF PIPE ELEVATION:
DIAMETER OF BOREHOLE:
OBSERVATION WELL/PIEZOMETER (circle):
DIAMETER OF PIPE: 2"
FALL/RISE TEST (circle) Both
SCREEN LENGTH:
FORMATION WELL SCREENED IN:
EFFECTIVE SCREEN LENGTH* "L":
STATIC WATER LEVEL (T.C.P.):



*"L" length is less than the sand pack length if the water table intersects sand pack, where "L" will equal distance between water table and bottom of sand pack.

SILOG II LOGGING SEQUENCE

SEGMENT NUMBER	NUMBER OF READINGS	INTERVAL (SEC.)	SEGMENT DURATION (SEC.)	ELAPSED TIME (SEC.)
1	50	0.2	10	10
2	15	1	15	15
3	15	2	30	30
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

PRESSURE TRANSDUCER PSI: 15
STAINLESS STEEL SLUG LENGTH: 4'

NOTES:

TEST PERFORMED BY: C Fevehe, S. Spiewak, E. Skasey DATE: 12-1-90
LOGGER DOWNLOADED BY: C. Fevehe DATE: 12-1-90
CALCULATIONS BY: DATE:
COMPUTER FILE NAME:

INFIELD HYDRAULIC CONDUCTIVITY SLUG TEST

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SHEET 1 OF 1

PROJECT NO.: 20026.023

WELL NUMBER: WT 106 A

SITE: HIMCO

LOGGER ID NUMBER: 719021

CLIENT: EPA

TOTAL DEPTH OF WELL: 18.50'

WELL DRILLED BY: Mathes

DEPTH OF WATER IN WELL: 8.45'

DATE TEST PERFORMED: 12-1-90

INITIAL TRANSDUCER WATER LEVEL: 9.02

TIME TEST PERFORMED: 1530

STATIC TRANSDUCER WATER LEVEL: 9.02

TOP OF PIPE ELEVATION:

DIAMETER OF BOREHOLE:

OBSERVATION WELL/PIEZOMETER (circle):

DIAMETER OF PIPE: 2"

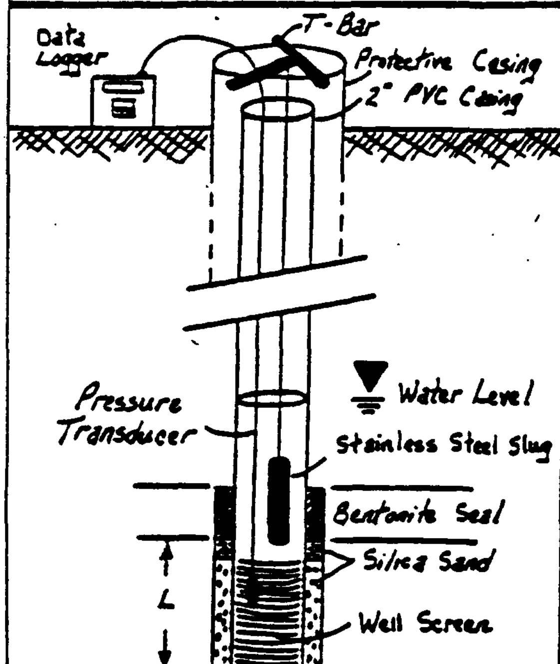
FALL/RISE TEST (circle) Both

SCREEN LENGTH:

FORMATION WELL SCREENED IN:

EFFECTIVE SCREEN LENGTH* "L":

STATIC WATER LEVEL (T.C.P.):



*"L" length is less than the sand pack length if the water table intersects sand pack, where "L" will equal distance between water table and bottom of sand pack.

SILOG II LOGGING SEQUENCE

SEGMENT NUMBER	NUMBER OF READINGS	INTERVAL (SEC.)	SEGMENT DURATION (SEC.)	ELAPSED TIME (SEC.)
1	50	0.2	10	10
2	15	1	15	15
3	15	2	30	30
4				
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16				

PRESSURE TRANSDUCER PSI: 15

STAINLESS STEEL SLUG LENGTH: 4'

NOTES:

TEST PERFORMED BY: C. Fluehr, S. Spierniak, E. Slusser DATE: 12-1-90

LOGGER DOWNLOADED BY: C. Fluehr DATE: 12-1-90

CALCULATIONS BY: DATE:

COMPUTER FILE NAME:

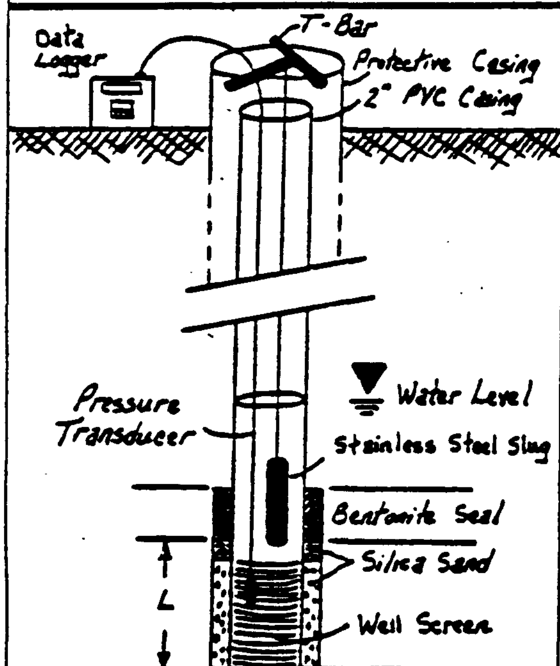
INFIELD HYDRAULIC CONDUCTIVITY SLUG TEST

SHEET 1 OF 1

Donohue ENGINEERS ARCHITECTS SCIENTISTS

PROJECT NO.: 20026.023
WELL NUMBER: P102C
SITE: HIMCO DUMP
LOGGER ID NUMBER: 05

CLIENT: USEPA
TOTAL DEPTH OF WELL: 158.81
WELL DRILLED BY: John Mathes & Assoc
DEPTH OF WATER IN WELL: 149.40
DATE TEST PERFORMED: Jan 4, 1991
INITIAL TRANSDUCER WATER LEVEL: 11.29'
TIME TEST PERFORMED: 1330
STATIC TRANSDUCER WATER LEVEL: 10.85'
TOP OF PIPE ELEVATION:
DIAMETER OF BOREHOLE: 8"
OBSERVATION WELL/PIEZOMETER (circle):
DIAMETER OF PIPE: 2"
FALL/RISE TEST (circle) BOTH
SCREEN LENGTH: 5'
FORMATION WELL SCREENED IN: OUTWASH
EFFECTIVE SCREEN LENGTH* "L": 5'
STATIC WATER LEVEL (T.C.P.): 9.41'



*"L" length is less than the sand pack length if the water table intersects sand pack, where "L" will equal distance between water table and bottom of sand pack.

SILOG II LOGGING SEQUENCE

SEGMENT NUMBER	NUMBER OF READINGS	INTERVAL (SEC.)	SEGMENT DURATION (SEC.)	ELAPSED TIME (SEC.)
1				
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14				
15				
16				

PRESSURE TRANSDUCER PSI: 5
STAINLESS STEEL SLUG LENGTH: 4

NOTES: Water level did not drop during falling head test

TEST PERFORMED BY: TOM PUCHALSKI
DATE: Jan 4, 1991
LOGGER DOWNLOADED BY: Kim Elias
DATE: 1/14/91
CALCULATIONS BY: KE
DATE:
COMPUTER FILE NAME: P102CR
" F

TECHNICAL MEMORANDUM NUMBER 12

DATE: February 17, 1991

TO: Vanessa Harris, Site Manager

CC: Roman Gau, Project Manager
Mike Crosser, TSQAM

FROM: Marcia A. Kuehl

PRELIMINARY

SUBJECT: EPA ARCS Region V Contract No. 68-W8-0093
EPA Work Assignment No. 17-5L4J
Donohue Project No. 20026.024
Himco Dump Site, Elkhart, Indiana

Waste Mass Gas Sampling

This technical memorandum presents the waste mass gas sampling method and the analytical results from three initial samples which were used to establish sample collection times and pump rates.

Introduction

Characterization of the Himco Dump Site waste mass gas was necessary to select appropriate remedial alternatives and develop the risk assessment. Typical municipal landfill gas consists of methane, hydrogen sulfide, and selected volatile organics. Historical site groundwater data indicates the presence of acetone, trans-1,2-dichloroethene, chloroethane, chlorofluoromethane, and dichlorodifluoromethane in shallow groundwater. No historical waste mass gas or ambient air data exists for the site. Accordingly, samples were collected and analyzed for the EPA Target Compound List volatile organics and up to 10 tentatively identified volatile organic compounds.

Twelve cap soil sampling locations, as shown in Figure 1, were selected for waste mass gas collection. These locations were chosen based on the highest field VOC readings, as measured by the HNu, or where the highest methane or hydrogen sulfide ambient concentrations, as measured by the Lumidor Gasponder IV meter, were noted in the 0- to 18-inch soil sample headspace.

Two sampling events were conducted. On November 7, 1990, three samples were collected at location G-20 by Marcia Kuehl and Dorothea Downs (Ebasco) in order to establish pump rates and sample collection times. The collection time and pump rate must be sufficient to collect enough sample volume for analysis yet not saturate the Tenax® adsorbent. On November 13 and 14, 1990, the remaining locations were sampled by Marcia Kuehl, Tom Puchalski, and Dorothea Downs. One trip blank, one field blank, one field duplicate, two matrix spikes, and two matrix spike duplicates were also collected on November 13 and 14, 1990, for a total of 18 samples sent for analysis.

Methods

The following equipment and materials were used during the waste mass gas sampling:

1. Lumidor Gasponder IV Model PGM-14 (for measurement of methane and hydrogen sulfide).
2. Hollow perforated nickel plated alloy steel soil probe, 10 feet maximum length x 5/8 inch OD.
3. KVA Macho portable soil gas probe system.
4. Gilian Gilair peristaltic sampling pump.
5. Digital soap bubble flow meter - EZ Cal Sensidyne.
6. HNu photoionization detector.
7. Stop watch.
8. Teflon tubing.
9. Tenax/charcoal sorbent tubes (supplied by CLP SAS lab).
10. Tenax sorbent tubes (supplied by CLP SAS lab).
11. Culture tubes (supplied by CLP SAS lab).
12. Friction-top can with charcoal for packaging.
13. Freezer.
14. Water, deionized and tap.
15. Isopropanol (A.C.S.).
16. Five-gallon pail with cover to contain isopropanol rinses.
17. Liquinox soap.
18. Brushes.
19. EPA Region V sample tags and SMO traffic report labels.
20. Plastic bags.
21. Camera and film.
22. Polyester gloves.
23. Generator (20 amp, 120 volt), gas powered.

The local weather station was called each morning prior to sample collection to get the current temperature, wind speed and direction, humidity, and barometric pressure. Sampling was done when winds were below 10 mph and no rain or snow was present. High winds disperse vapors emanating from the borehole, and moisture in the tenax and charcoal sorbents interfere with the chemical analysis. The cap soil sampling field team chose the gas sample locations based on the highest field measurement of methane, hydrogen sulfide, or volatile organics in the 0- to 18-inch soil sample headspace, or locations with the most significant odor and evidence of buried waste.

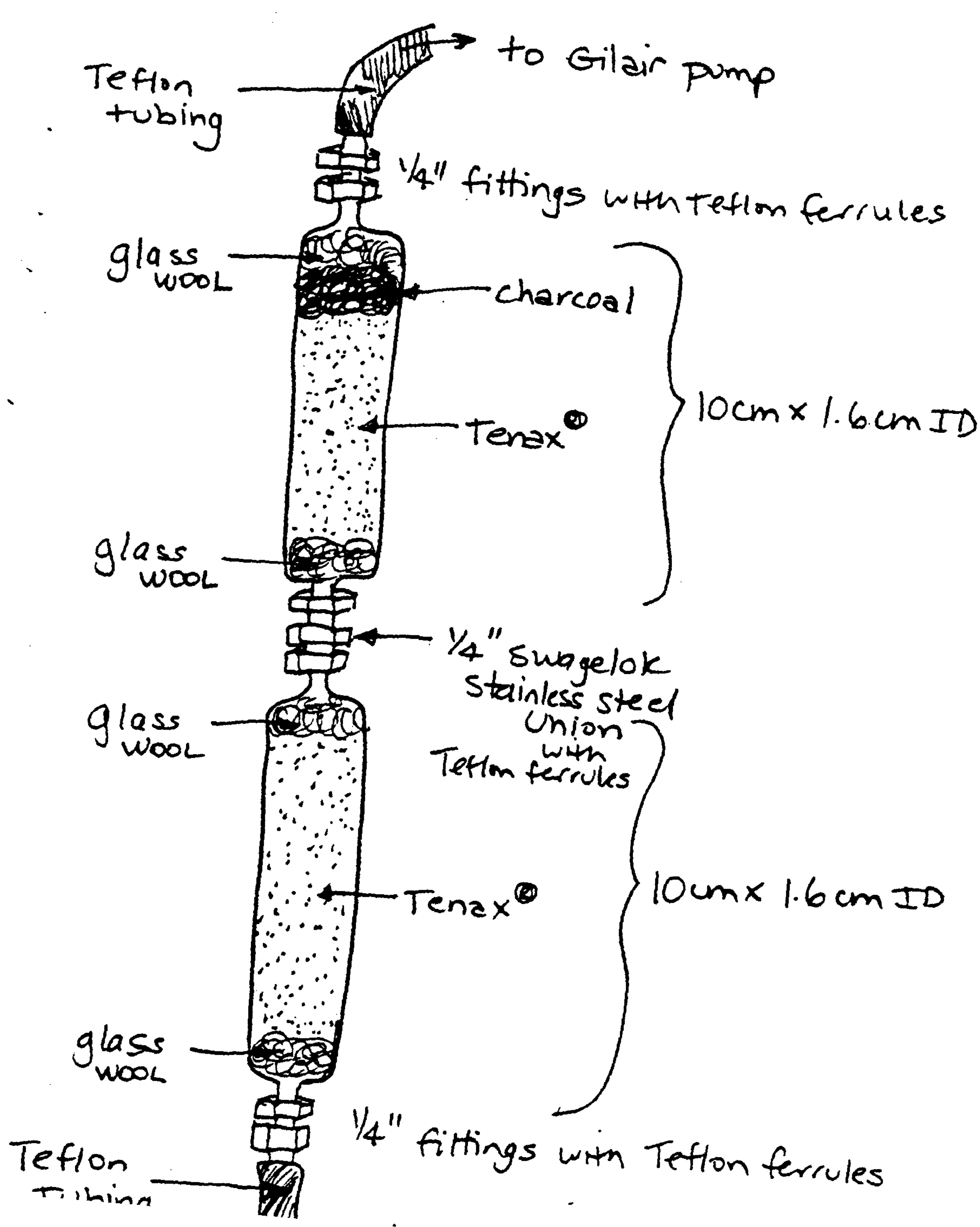
The pump and a dummy sorbent tube assembly was calibrated daily prior to sample collection with the EZ Cal Sensidyne digital soap bubble flow meter using seven readings. Multiple readings are recommended by the flow meter calibrator manufacturer due to the inherent variability of the bubbles generated. The mean value of readings was used as the actual pump rate because the pump rotameter reading scale was not readable to within 0.10 liters/minute.

The KVA Macho® System 13-pound air rotary hammer, powered by a gas powered generator, was used to drive the stainless steel probe into the ground. A 3-foot sampling interval was attempted at each location. Gas inlets were at

FIGURE 2

SAMPLING TRAIN
HIMCO DUMP

I/I DESIGN



The total volumetric flow for each cartridge was calculated and recorded on the Soil Gas Survey Form using the following equation:

$$V_m = \frac{T \times Q_A}{1000}$$

where:

Q_A = Flow rate in ml/minute

V_m = Total volume sampled in liters at measured temperature and pressure

T = Sampling time = $T_2 - T_1$, minutes

T_2 = Stop time

T_1 = Start time

The total volume (V_s) at standard conditions, 25°C and 760 mmHg, was then calculated from the following equation and included on the chain-of-custody form so the lab could report results in ng/l.

$$V_s = V_m \times \frac{P_A}{760} \times \frac{298}{273 + t_A}$$

where:

P_A = Average barometric pressure, mmHg
t_A = Average ambient temperature, °C

Summary of Results

Samples as listed in Table TM__-1 were collected. Field trial sample analytical results are in Attachment C and detected compounds are summarized in Table TM__-2.

Compounds detected were indicative of aerosol can disposal (1,1,2-trichloro-, 1,2,2-trifluoroethane), solvent disposal (methylene chloride, acetone, benzene, toluene, 1,1,1-trichloroethane), and landfill gas (carbon disulfide) from waste decomposition. Disposal of aerosol cans and associated industrial solvents has been suspected at Himco Dump and noted by nearby residents.

Deviations

The following deviations from the Field Sampling Plan occurred, but were not judged by the Site QC officer and Site Manager as negatively impacting data quality:

1. Borehole equilibration was done for 15 minutes rather than the 5 minutes specified in the FSP. The time was extended after evaluation of the data

collected on November 7, 1990, which indicated that the greatest concentration of 1,1,2-trichloro - 1,2,2-trifluoroethane was measured in the sample collected after the borehole was open for 15 minutes.

2. The initial sampling rate specified in the FSP was 1 liter/min for 20 minutes. Based on conversations with other ARCS contractors familiar with use of the VOST sorbent tube assembly for gas sampling and the analytical laboratory, a rate of approximately 4 liters/minute was selected. Sampling times of 16.87 minutes, 12.18 minutes, and 5.00 minutes were used on November 7, 1990, during the field trial. Based on these results, a sample volume (V_s) of approximately 2 liters was selected using a pump flow rate of approximately 4 liters/minute for 10 minutes, and the borehole was left open to equilibriate for 15 minutes after probe insertion. Remaining samples, HDTT04-HDTT07, HDTT10-HHFDTT16, were collected using these operating parameters.

3. The FSP indicated that two sampling locations were to be sampled during the field trial. Only one location was sampled as the weather was threatening, and rain was expected.

4. The Corporate Health and Safety Manager reviewed the sampling and documentation during the initial field trial.

5. A bottle blank, as specified by the FSP, was not collected. A field blank consisting of a pair of sorbent tubes uncapped and exposed to site ambient air for the sampling period (10 minutes) was collected based on advice from the CLP laboratory and other ARCS contractors.

6. Two sets of matrix spike and matrix spike duplicate sorbent tubes were collected and consisted of four sets of unexposed tubes. These samples were added as the SAS method specified this QC requirement at a frequency of 1 per 10 field samples.

7. Refusal occurred during sampling due to the 3-foot sample interval could not be achieved for all samples, as indicated in Table TM___-1.

A/R/HIMCO/AA5

TABLE TM__-1

VOLATILE MASS GAS SAMPLES COLLECTED
Himco Dump Site
Elkhart, Indiana

Grid Point Location	Borehole equil. time (min.)	Sample Number	Sample Depth (ft.)	Mean Pump Flow Rate L/min.	Sample Time (min.)	Total Volumetric Flow (V_s) (liters)
G-20	5	HD-TT01	0.75	4.21	16.87	3.01
G-20	17	HD-TT02	0.75	4.21	12.18	2.17
G-20	30	HD-TT03	0.75	4.21	5.00	0.89
OFF-SITE	15	HD-TT04	3.0	4.17	10.00	1.84
R-12	15	HD-TT05	2.4	4.17	10.00	1.84
Q-8	15	HD-TT06	2.7	4.17	10.00	1.84
O-15	15	HD-TT07	3.0	4.17	10.00	1.84
FIELD BLANK	--	HD-FBTT08	0	--	10.00	--
TRIP BLANK	--	HD-TBTT09	--	--	--	--
L-18	15	HD-TT10	2.0	4.17	10.00	1.75
L-21	15	HD-TT11	2.6	4.17	10.00	1.75
I-22	15	HD-TT12	3.0	4.17	10.00	1.75
D-24	15	HD-TT14	3.0	4.17	10.00	1.75
F-25	15	HD-TT15	3.0	4.17	10.00	1.75
K-14	15	HD-TT16	3.0	4.17	10.00	1.75
K-14	15	HD-FDTT16	3.0	4.17	10.00	1.75
Matrix Spike	--	HD-TTMS01	--	--	--	--
Matrix Spike	--	HD-TTMS02	--	--	--	--
Matrix Spike Duplicate	--	HD-TTMSD01	--	--	--	--
Matrix Spike Duplicate	--	HD-TTMSD02	--	--	--	--

TABLE TM___-2

WASTE MASS GAS FIELD TRIAL ANALYTICAL RESULTS
Himco Dump Site
Elkhart, Indiana

Detected Volatile Organic	HD-TT01 ng/L	HD-TT02 ng/L	HD-TT03 ng/L
Methylene Chloride	2.66 B	7.83 B	14.6
Acetone	5.31	8.29	17.9
Benzene	0.66 J	1.84	2.25
Toluene	23.9	30.9	21.3
1,1,2-Trichloroethane-1,2,2-Trifluoroethane	19.9	138	225
Unknown Hydrocarbon (RT 11.26)	3.32	9.22	ND
Carbon Disulfide	ND	3.22	ND
1,1,1-Trichloroethane	ND	2.30	ND
Unknown Hydrocarbon (RT 16.22)	ND	3.69	ND

Legend:

B - Detected in unexposed lab blank tubes.
J - Estimated concentration, below detection limit.
ND - Not detected.
RT - Retention Time, in units.

A/R/HIMCO/AA5

ATTACHMENT A

VOST BLANK CHECK RESULTS

INTERNATIONAL TECHNOLOGY CORPORATION

VOST Blank Check Results

ITAS Cincinnati

Client I.D. USEPA - VIAR | W.O.# X0-10-293

Date	Analyst	Tube No.s	Batch	Acetone	Benzene	Hexane	Perc	Toluene	DONOHUE #	SITE		Unknown (1)	Can No.
10/24	VR	T4161 Tc1555	301	—	1.3	—	4.0	0.8	TT10	L-18		<5ng	1
		T3262 Tc35		3.3	1.9	1.0	12.0	0.7	TT12	I-22			
		T14 Tcx4241		6.0	3.9	0.5	11.4	0.9	TT09	TB			
		T60 Tc4640		4.5	2.2	1.3	12.9	0.8	TT08	FB	Tube says 4648		
		TT-100 Tc47		5.3	3.0	1.1	10.0	0.9	TT05	R-12			
		T2154 Tc4602		6.1	2.1	1.5	7.7	0.6	TT04	UPWIND			
10/26		T4721 Tc4752	302	—	0.8	—	—	—					
		T4488 Tc4741		1.4	1.9	1.3	4.2	0.7	TT06	Q-8			
		T4211 Tc4754		7.3	2.3	4.0	8.2	0.9	TT11	L-21			
		T3407 Tc4744		1.0	1.3	1.4	4.5	0.6	TT07	O-15			
		T4717 Tc4484		2.6	1.3	1.6	3.0	0.5	MS01				2
		T4673 Tc4735		—	1.1	0.5	3.7	0.4	MSD01				
		T4694 Tc4141		1.1	0.9	0.8	0.8	0.5	MSD02				
		T4727 Tc4126		2.5	1.5	0.9	—	—	TT16	F-14			
		T4698 Tc4742		—	1.4	1.2	—	0.6	FDTT16	F-14			
		T4713 Tc4748		2.6	1.0	1.2	—	0.4					
		T4716 Tc4648		6.8	2.2	0.6	9.7	0.5	TT14	D-24			
10/28		T4715 Tc3148		8.8	3.3	0.6	—	0.7	MS02				
		T42 Tc3182		6.0	1.9	1.1	—	0.5	TT15	F-25			
		T4670 Tc4538		5.1	1.4	2.4	—	—					
		T4723 Tc3619		7.6	1.5	0.8	—	0.6	TT13	I-21			

(1) based on benzene response factor for the largest unknown peak in run. All values are listed as NG per pair.

INTERNATIONAL TECHNOLOGY CORPORATION

VOST Blank Check Results

ITAS
Cincinnati

Client I.D. USEPA - VIAR	W.O. # 10-10-273

Date	Analyst	Tube No.s	Batch	Acetone	Benzene	Hexane	Perc	Toluene	EPA ID	DENCHIE ID	Vm Liters*	Unknown (1)	Can No.
10/31	RP/mm	T4629 Tc4410	305	0.6	1.0	1.3	—	0.6	TT01	6-20	~~70.95~~ 71.02	<5ng	1
		T3885 Tc2315		1.4	17	2.0	8.8	0.9	used to pumps	calibrate MAK	11/4/90		
		T2491 Tc3366		0.7	13	17	—	0.8					
		T4131 Tc438		10	13	13	2.5	0.6	TT03	6-20	~~27.55~~ 35.05		
		T2322 Tc4475		0.8	1.5	2.2	2.8	0.8	TT02	6-20	~~57.38~~ 51.28		
11/1		T4483 Tc3989		—	0.5	0.5	—	11	extra				

(1) based o[n] [ben]zene response factor for the largest unknown peak in run. All [values] are listed as NG per pair. *uncorrected to STD conditions (Vm)

ATTACHMENT B

SOIL GAS SURVEY FORMS

Donahue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

CLIENT: EPA ARCS DATE: 11/7/90 EPA SAS NO.: 5798 E-1/E-

SITE: Himco DONOHUE SPL NO.: HD IT01

PROJECT NO.: 20026

SAMPLING TEAM: Marcia Kuehl, Dorothea Downs

SAMPLING CONDITIONS

Gastech GX86 (cal 11/7

TEMPERATURE: 40 °F – 32 x 5/9 = 4.4 °C (tA) HNu: 0.20 ppm

BAROMETRIC PRESSURE (PA): 30.05 mm Hg at 0800 AM/PM H_2S: 0 ppm

RELATIVE HUMIDITY: 92 % CH_4: 0 % LEL

WIND: 5-10 mph from SW

WEATHER: cloudy, sleet

SAMPLE GRID COORDINATES.: ______ N ______ E Grid point G-20 near frac tank

SAMPLING INTERVAL: 18-24"

SOIL CONDITIONS AT SURFACE: wet, moss growing on soil

PUMP CALIBRATION

Cal reading
4.208 4.218
4.202 4.196
4.215 4.203
4.202

PUMP MFG/MODEL/SN: Gilian SN2961 (Gilair)

CALIBRATOR MFG/MODEL/SN: E2Cal/Sensidyne /251222

INITIAL CALIBRATION (QA) TO ~~4.2057~~ 4.21 (n=7) L/MIN AT TIME: 0900

CALIBRATION VERIFICATION: ROTAMETER READING 4.0 L/min TIME: 0900

*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE ROTAMETER READING 4.0 L/min TIME: 1330

% DIFFERENCE 0

SAMPLE COLLECTION

TENAX ~~CHARCOAL~~ TUBE NUMBER: TC4490 E-1 ~~CHARCOAL~~ TENAX TUBE NUMBER: T4629 E-2

STOP TIME: 11:53:52 COLLECTION CONDITIONS: Drilling ~3" refusal at 12", Calcium sulfate underneath refusal at 18"

START TIME: 11:37:00

TIME ELAPSED (T) 16:52 sec MINUTES 16.87 min

TOTAL VOLUMETRIC FLOW CALCULATION

Vm = T x QA = 16.87 x ~~4.206~~ 4.21 = ~~70.95~~ 71.02 LITERS (Vm)

$Vs = Vm \times \frac{PA}{760} \times \frac{298}{273 + tA}$ (tA = 4.4) = 3.01 LITERS (Vs)*

*RECORD Vs IN LITERS ON SAS CHAIN OF CUSTODY REMARKS COLUMN.

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

CLIENT: EPA ARCS DATE: 11/7/90 EPA SAS NO.: 5798E-3/E-

SITE: Himco DONOHUE SPL NO.: HDTT02

PROJECT NO.: 20026.

SAMPLING TEAM: Marcia Kuehl Dorothea Downs

SAMPLING CONDITIONS

See 11/7/90,

TEMPERATURE: ______ °F – 32 x 5/9 = ______ °C (tA) HNu: ______ ppm

BAROMETRIC PRESSURE (P_A): ______ mm Hg at ______ AM/PM H_2S: ______ ppm

RELATIVE HUMIDITY: ______ % CH_4: ______ % LEL

WIND: ______ mph from ______

WEATHER: ______

SAMPLE GRID COORDINATES.: ______ N ______ E Same borehole as TT01

SAMPLING INTERVAL: ______ ft

SOIL CONDITIONS AT SURFACE: ______

PUMP CALIBRATION

See 11/7/90 TT01

PUMP MFG/MODEL/SN: ______

CALIBRATOR MFG/MODEL/SN: ______

INITIAL CALIBRATION (Q_A) TO ______ L/MIN AT TIME: ______

CALIBRATION VERIFICATION: ROTAMETER READING ______ TIME: ______

*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE ROTAMETER READING ______ TIME: ______

% DIFFERENCE ______

SAMPLE COLLECTION

TENAX & CHARCOAL TUBE NUMBER: TC 4475 E-3 ~~CHARCOAL~~ TENAX TUBE NUMBER: T 2322 E-4

STOP TIME: 12:19:25 COLLECTION CONDITIONS: ______

START TIME: 12:07:14

TIME ELAPSED (T) 12:11 sec MINUTES

12.18 min

TOTAL VOLUMETRIC FLOW CALCULATION

Vm = T x QA = 12.18 x ~~4.206~~ 4.21 /min = ~~57.33~~ 51.28 LITERS (Vm)

Vs = Vm x PA/760 x 298/(273 + tA) = 2.17 LITERS (Vs)*

4.4

*RECORD Vs IN LITERS ON SAS CHAIN OF CUSTODY REMARKS COLUMN.

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

CLIENT: EPA ARCS DATE: 11/7/90 EPA SAS NO.: 5748E-5/E-6

SITE: Himco DONOHUE SPL NO.: HDTT03

PROJECT NO.: 20026.

SAMPLING TEAM: Maria Kuchl Dorothea Davis

SAMPLING CONDITIONS

See 11/7/90 TT01

TEMPERATURE: ______ °F − 32 x 5/9 = ______ °C (tA) HNu: ______ ppm

BAROMETRIC PRESSURE (PA): ______ mm Hg at ______ AM/PM H_2S: ______ ppm

RELATIVE HUMIDITY: ______ % CH_4: ______ % LEL

WIND: ______ mph from ______

WEATHER: ______

SAMPLE GRID COORDINATES.: ______ N ______ E

SAMPLING INTERVAL: ______ ft

SOIL CONDITIONS AT SURFACE: ______

PUMP CALIBRATION

See 11/7/90 TT01

PUMP MFG/MODEL/SN: ______

CALIBRATOR MFG/MODEL/SN: ______

INITIAL CALIBRATION (QA) TO ______ L/MIN AT TIME: ______

CALIBRATION VERIFICATION: ROTAMETER READING ______ TIME: ______

*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE ROTAMETER READING ______ TIME: ______

% DIFFERENCE ______

SAMPLE COLLECTION

E-5 TENAX + CHARCOAL TUBE NUMBER: TC 438 E-6 ~~CHARCOAL~~ TENAX TUBE NUMBER: T 4131

STOP TIME: 12:23:23 COLLECTION CONDITIONS: see 11/7/90 TT01

START TIME: 12:23:23

TIME ELAPSED (T) 5.00 MINUTES

TOTAL VOLUMETRIC FLOW CALCULATION

Vm = T x QA = 5.00 x 4.21 ~~4.206~~ = 21.05 ~~23.55~~ LITERS (Vm)

$Vs = Vm \times \frac{PA}{760} \times \frac{298}{273 + tA}$ = 0.89 LITERS (Vs)*

4.4

*RECORD Vs IN LITERS ON SAS CHAIN OF CUSTODY REMARKS COLUMN.

0900 Am

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

CLIENT: EPA ARCS DATE: 11/13/90 EPA SAS NO.: 5798E E-1 E

SITE: Himco DONOHUE SPL NO.: HDTC4

UPWIND OFFSITE

PROJECT NO.: 20026

SAMPLING TEAM: M. Kuehl / D. Dawns / T. Pichalski

SAMPLING CONDITIONS

TEMPERATURE: 25 °F – 32 x 5/9 = ____ °C (tA) HNu: 0 ppm

BAROMETRIC PRESSURE (PA): 30.23 mm Hg at 0715 AM/PM H2S: 0 ppm

RELATIVE HUMIDITY: 92 % CH4: 0 % LEL

WIND: 0 mph from ~~N-NE~~ MAK

WEATHER: Sunny

SAMPLE GRID COORDINATES.: 50' N of S-10 ~~E~~ MAK

SAMPLING INTERVAL: 3.0 ft

SOIL CONDITIONS AT SURFACE: frosty, leaves moist (in woods)

PUMP CALIBRATION

cal readings: (4min) 4.211 4.138 4.226 4.028 4.218 4.15 4.19

PUMP MFG/MODEL/SN: Giliad/Gilair /3146

CALIBRATOR MFG/MODEL/SN: Ezcal Sensidyne /251222

INITIAL CALIBRATION (QA) TO $\bar{x}$=4.17 (n=7) L/MIN AT TIME: 0530

CALIBRATION VERIFICATION: ROTAMETER READING 4 L/min TIME: 0850

*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE ROTAMETER READING 4 L/min TIME: 0915

% DIFFERENCE 0

SAMPLE COLLECTION

TENAX + CHARCOAL TUBE NUMBER: E-12 ~~E-7~~ MAK TC4602 MAK ~~CHARCOAL~~ TENAX TUBE NUMBER: E-13 ~~E-8~~ MAK T2154

STOP TIME: ____ COLLECTION CONDITIONS: may have hit

START TIME: ~~used stopwatch~~ water table, suction created at

TIME ELAPSED (T) 10.00.06 MINUTES T= 2min

TOTAL VOLUMETRIC FLOW CALCULATION

Vm = T x QA = 10.00 x 4.17 = 41.7 LITERS (Vm)

$Vs = Vm \times \frac{PA}{760} \times \frac{298}{273 + tA}$ = 1.34 LITERS (Vs)*

*RECORD Vs IN LITERS ON SAS CHAIN OF CUSTODY REMARKS COLUMN.

10:45AM

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

CLIENT: EPA ARCS DATE: 11/13/90 EPA SAS NO.: 5793E

SITE: Himco DONOHUE SPL NO.: TT05 ~~E-7~~, ~~E-~~ E-14, E-

PROJECT NO.: 20026

SAMPLING TEAM: M Kuehl / D Downs / Tom Puchalski

SAMPLING CONDITIONS

TEMPERATURE: 25 °F − 32 x 5/9 = ______ °C (tA) HNu: 0 ppm

BAROMETRIC PRESSURE (PA): 30.23 mm Hg at 0715 AM/PM H_2S: 0 ppm

RELATIVE HUMIDITY: 92 % CH_4: 0 % LEL

WIND: 0 mph from ______

WEATHER: Sunny

SAMPLE GRID COORDINATES.: ______ N ______ E R-12

SAMPLING INTERVAL: 2'5" ft, refusal

SOIL CONDITIONS AT SURFACE: visible $CaSO_4$, sand H2S odor ambient

PUMP CALIBRATION see also TT04 for cal readings

PUMP MFG/MODEL/SN: Gilian / Gilair / 2196

CALIBRATOR MFG/MODEL/SN: EZ Cal Sensidyne / 251222

INITIAL CALIBRATION (QA) TO $\bar{X}$ = 4.17 (n=7) L/MIN AT TIME: 0530

CALIBRATION VERIFICATION: ROTAMETER READING 4.04 l/m TIME: 10:30

*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE ROTAMETER READING 4.04 l/m TIME: 11:05

% DIFFERENCE 0

SAMPLE COLLECTION

E-14 ~~E-7~~ with TENAX

CHARCOAL TUBE NUMBER: TC47 ~~CHARCOAL~~ TENAX TUBE NUMBER: TT100 ~~with~~ E-15

STOP TIME: ~~used~~ 10:55 COLLECTION CONDITIONS: ______

START TIME: ~~stopwatch~~ 10:45AM Vacuum created at T=2 min

TIME ELAPSED (T) 10.00.00 MINUTES $CaSO_4$ with yellow labels subsurface

TOTAL VOLUMETRIC FLOW CALCULATION

Vm = T x QA = 10.00 x 4.17 = 41.7 LITERS (Vm)

$Vs = Vm \times \frac{PA}{760} \times \frac{298}{273 + tA}$ = 1.34 LITERS (Vs)*

*RECORD Vs IN LITERS ON SAS CHAIN OF CUSTODY REMARKS COLUMN.

11:50AM

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

CLIENT: EPA ARCS DATE: 11/13/90 EPA SAS NO.: 5748E ~~E-11~~ E-16, E-17 etc.

SITE: Himco DONOHUE SPL NO.: HDTT06

PROJECT NO.: 20026

SAMPLING TEAM: M. Kuehl / D. Downs / T. Puchalski

SAMPLING CONDITIONS

TEMPERATURE: 25 °F – 32 x 5/9 = ______ °C (tA) HNu: 0 ppm

BAROMETRIC PRESSURE (P_A): 30.23 mm Hg at 0715 AM/PM H_2S: 0 ppm

RELATIVE HUMIDITY: 92 % CH_4: 0 % LEL

WIND: 0 mph from ______

WEATHER: sunny

SAMPLE GRID COORDINATES.: ______ N ______ E Q8

SAMPLING INTERVAL: 2' 8" ft

SOIL CONDITIONS AT SURFACE: grassy

PUMP CALIBRATION

See also TT04 for cal readings

PUMP MFG/MODEL/SN: Gilian / Gilair / 2196

CALIBRATOR MFG/MODEL/SN: E2Cal / Sensidyne / 251222

INITIAL CALIBRATION (Q_A) TO $\bar{x}$=4.17 (n=7) L/MIN AT TIME: 0530

CALIBRATION VERIFICATION: ROTAMETER READING 4.0 TIME: 11:?2

*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE ROTAMETER READING 4.01 TIME: 12:05

% DIFFERENCE 0

SAMPLE COLLECTION

E-11 TENAX + CHARCOAL TUBE NUMBER: TC4741 E-12 ~~CHARCOAL~~ TENAX TUBE NUMBER: T4488

STOP TIME: 12:00 COLLECTION CONDITIONS: ______

START TIME: 11:50

TIME ELAPSED (T) 10.00.00 MINUTES

TOTAL VOLUMETRIC FLOW CALCULATION

$V_m = T \times Q_A =$ 10.00 x 4.17 = 41.7 LITERS (V_m)

$V_s = V_m \times \frac{P_A}{760} \times \frac{298}{273 + t_A} =$ 1.84 LITERS (V_s)*

*RECORD Vs IN LITERS ON SAS CHAIN OF CUSTODY REMARKS COLUMN.

~~1445~~ TIME ~~am~~ 1405

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

CLIENT: EPA 9ECS DATE: 11/13/90 EPA SAS NO.: 5798E E15 9

SITE: Hmio DONOHUE SPL NO.: HD TT07

PROJECT NO.: 20026

SAMPLING TEAM: M. Kuehl / D. Downs / T. Pucholski

SAMPLING CONDITIONS

TEMPERATURE: 48 °F − 32 x 5/9 = ______ °C (tA) HNu: 0 ppm

BAROMETRIC PRESSURE (PA): 30.23 mm Hg at ~~0715~~ 12:15 AM/PM H2S: 0 ppm

RELATIVE HUMIDITY: ______ % CH4: 0 % LEL

WIND: 0 mph from ______

WEATHER: Sunny

SAMPLE GRID COORDINATES.: ______ N ______ E 0-15

SAMPLING INTERVAL: 3.0 ft

SOIL CONDITIONS AT SURFACE: H2S odor - intermittent ambient moist, moss

PUMP CALIBRATION

PUMP MFG/MODEL/SN: Gilian / Gilair / 2196

CALIBRATOR MFG/MODEL/SN: EZ Cal / Sensidyne / 251222

INITIAL CALIBRATION (QA) TO $\bar{x}$ = 4.17 (n=7) L/MIN AT TIME: 0530

CALIBRATION VERIFICATION: ROTAMETER READING 4.0 TIME: 1340

*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE ROTAMETER READING 4.0 TIME: 1510

% DIFFERENCE 0

SAMPLE COLLECTION

E-18 TENAX ~~CHARCOAL~~ TUBE NUMBER: TC 4744 E-19 ~~CHARCOAL~~/TENAX TUBE NUMBER: T3907

STOP TIME: used COLLECTION CONDITIONS:

3:50 hole open START TIME: stopwatch vacuum created at T=1 min

TIME ELAPSED (T) 10.00.00 MINUTES took field blank at this location

TOTAL VOLUMETRIC FLOW CALCULATION

Vm = T x QA = ~~4 min~~ 10.00 x 4.17 = LITERS (Vm)

Vs = Vm x PA/760 x 298/(273 + tA) = 1.75 LITERS (Vs)*

*RECORD Vs IN LITERS ON SAS CHAIN OF CUSTODY REMARKS COLUMN.

1405

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

CLIENT: EPA ARCS DATE: 11/13/90 EPA SAS NO.: 5798E / E-20 FB .21

SITE: Amco DONOHUE SPL NO.: HDTT08 Field Blank

PROJECT NO.: 20026

SAMPLING TEAM: M Kiehl / D. Downs / T. Puchalski

SAMPLING CONDITIONS

TEMPERATURE: 43 °F – 32 x 5/9 = ______ °C (tA) HNu: 0 ppm

BAROMETRIC PRESSURE (PA): 30.23 mm Hg at 1215 AM/PM H2S: 0 ppm

RELATIVE HUMIDITY: ______ % CH4: 0 % LEL

WIND: 0 mph from ______

WEATHER: Sunny

SAMPLE GRID COORDINATES.: ______ N ______ E taken at TT07

SAMPLING INTERVAL: 0 ft ambient air only

SOIL CONDITIONS AT SURFACE: NA

PUMP CALIBRATION pump not used

PUMP MFG/MODEL/SN: ______ MFK

CALIBRATOR MFG/MODEL/SN: ______

INITIAL CALIBRATION (QA) TO ______ L/MIN AT TIME: ______

CALIBRATION VERIFICATION: ROTAMETER READING ______ TIME: ______

*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE ROTAMETER READING ______ TIME: ______

% DIFFERENCE ______

SAMPLE COLLECTION

E-20 TENAX & CHARCOAL TUBE NUMBER: TC 46480 mk E-21 ~~CHARCOAL~~ TENAX TUBE NUMBER: T60

STOP TIME: used COLLECTION CONDITIONS:

START TIME: stopwatch opened end caps for 10 minutes

TIME ELAPSED (T) 10.00 MINUTES + recapped at location TT07

TOTAL VOLUMETRIC FLOW CALCULATION

$V_m = T \times Q_A =$ ~~4.7~~ NA x ~~10.20~~ NA = LITERS (Vm) not applicable

$V_s = V_m \times \frac{P_A}{760} \times \frac{298}{273 + t_A} =$ ______ LITERS (Vs)*

*RECORD Vs IN LITERS ON SAS CHAIN OF CUSTODY REMARKS COLUMN.

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

ND-ME
QC

CLIENT: EPA ARCS DATE: 11/13/90 EPA SAS NO.: 5798E E 22 2

SITE: Himco DONOHUE SPL NO.: HD/TT09

TRIP BLANK

PROJECT NO.: 20026

SAMPLING TEAM: M Kuen/D. Downs/T. Puchalski

SAMPLING CONDITIONS

TEMPERATURE: 48 °F – 32 x 5/9 = ______ °C (tA) HNu: 0 ppm

BAROMETRIC PRESSURE (PA): 30.23 mm Hg at 1215 AM/PM H_2S: 0 ppm

RELATIVE HUMIDITY: 92 % CH_4: 0 % LEL

WIND: 0 mph from ______

WEATHER: Sunny

SAMPLE GRID COORDINATES.: ______ N ______ E not applicable

SAMPLING INTERVAL: ______ ft

SOIL CONDITIONS AT SURFACE: ______

PUMP CALIBRATION

PUMP MFG/MODEL/SN: ______ not applicable

CALIBRATOR MFG/MODEL/SN: ______

INITIAL CALIBRATION (QA) TO ______ L/MIN AT TIME: ______

CALIBRATION VERIFICATION: ROTAMETER READING ______ TIME: ______

*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE ROTAMETER READING ______ TIME: ______

% DIFFERENCE ______

SAMPLE COLLECTION

E-22 ~~CHARCOAL~~ TENAX TUBE NUMBER: TCX4241 E-23 ~~CHARCOAL~~ TENAX TUBE NUMBER: T14

STOP TIME: ______ COLLECTION CONDITIONS: UNOPENED - ACCOMPANIED CAN 1 TUBES WHEN SHIPPED FROM LAB

START TIME: ______

TIME ELAPSED (T) NOT APPLICABLE MINUTES

TOTAL VOLUMETRIC FLOW CALCULATION

not applicable

$Vm = T \times QA =$ ______ x ______ = ______ LITERS (Vm)

$Vs = Vm \times \frac{PA}{760} \times \frac{298}{273 + tA} =$ ______ LITERS (Vs)*

*RECORD Vs IN LITERS ON SAS CHAIN OF CUSTODY REMARKS COLUMN

1450

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

CLIENT: EPA ARCS DATE: 11 3 90 EPA SAS NO.: 5798E E-24 25

SITE: HMW DONOHUE SPL NO.: HD II-10

PROJECT NO.: 20026

SAMPLING TEAM: M Kuehl/D. Downs/T Puchalski

SAMPLING CONDITIONS

TEMPERATURE: 28 °F – 32 x 5/9 = ______ °C (tA) HNu: 0 ppm

BAROMETRIC PRESSURE (PA): 30.23 mm Hg at 1215 AM/PM H2S: 0 ppm

RELATIVE HUMIDITY: 92 % CH_4: 0 % LEL

WIND: 0 mph from ______

WEATHER: sunny

SAMPLE GRID COORDINATES.: ______ N ______ E L-18

SAMPLING INTERVAL: 2.00 ft

SOIL CONDITIONS AT SURFACE: Sandy, visible $CaSO_4$

PUMP CALIBRATION

PUMP MFG/MODEL/SN: Gilian/Gilair /12196

CALIBRATOR MFG/MODEL/SN: Elcal /Sensidyne/251222

INITIAL CALIBRATION (QA) TO $\bar{X}$=4.17 (n=7) L/MIN AT TIME: 0530

CALIBRATION VERIFICATION: ROTAMETER READING 4.0 TIME: 1440

*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE ROTAMETER READING 4.0 TIME: 1505

% DIFFERENCE 0

SAMPLE COLLECTION

E-24 TENAX & CHARCOAL TUBE NUMBER: TC1555 E-25 ~~CHARCOAL~~/TENAX TUBE NUMBER: T4161

STOP TIME: ~~[illegible]~~ stopwatch COLLECTION CONDITIONS: no unusual conditions

START TIME:

TIME ELAPSED (T) 10.00.00 MINUTES

TOTAL VOLUMETRIC FLOW CALCULATION

Vm = T x QA = ~~4.17~~ 10.00 x 4.17 = 41.7 LITERS (Vm)

$Vs = Vm \times \frac{PA}{760} \times \frac{298}{273 + tA}$ = 1.75 LITERS (Vs)*

*RECORD Vs IN LITERS ON SAS CHAIN OF CUSTODY REMARKS COLUMN.

1525

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

CLIENT: EPA ARCS DATE: 11/13/90 EPA SAS NO.: 3793E E-7

SITE: HMW DONOHUE SPL NO.: HDTT-11

PROJECT NO.: 20026

SAMPLING TEAM: M Vuehl / D Downs / T Puchalski

SAMPLING CONDITIONS

TEMPERATURE: 48 °F − 32 x 5/9 = ______ °C (tA) HNu: 0 ppm

BAROMETRIC PRESSURE (PA): 30.23 mm Hg at 1215 AM/PM H2S: 0 ppm

RELATIVE HUMIDITY: 92 % CH4: 0 % LEL

WIND: 0 mph from ______

WEATHER: sunny, cooling off

SAMPLE GRID COORDINATES.: ______ N ______ E L-21

SAMPLING INTERVAL: 2' 7" ft refusal

SOIL CONDITIONS AT SURFACE: Sandy, dry

PUMP CALIBRATION

PUMP MFG/MODEL/SN: Gilian / Gilian / 2196

CALIBRATOR MFG/MODEL/SN: Elcal / Sensidyne / 251222

INITIAL CALIBRATION (QA) TO $\bar{X}$=4.17 (n=7) L/MIN AT TIME: 0530

CALIBRATION VERIFICATION: ROTAMETER READING 4.2 slpm TIME: 1510

*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE ROTAMETER READING 4.2 slpm TIME: 1530

% DIFFERENCE 0

SAMPLE COLLECTION

E-26 TENAX E

hole open 1510

CHARCOAL TUBE NUMBER: TC4754 E-27 ~~CHARCOAL~~ TENAX TUBE NUMBER: T4211

STOP TIME: ~~used~~ stopwatch

START TIME:

TIME ELAPSED (T) 10.00.00 MINUTES

COLLECTION CONDITIONS: Intermittent suction, rotameter variable (in waste?) during sampling period

TOTAL VOLUMETRIC FLOW CALCULATION

$Vm = T \times QA =$ 10.00 x 4.17 = 41.7 LITERS (Vm)

$Vs = Vm \times \frac{PA}{760} \times \frac{298}{273 + tA} =$ 1.75 LITERS (Vs)*

*RECORD Vs IN LITERS ON SAS CHAIN OF CUSTODY REMARKS COLUMN.

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

1555

CLIENT: EPA ARCS DATE: 11/13/90 EPA SAS NO.: 5745E-23 1
SITE: Himco DONOHUE SPL NO.: HDTT-12
PROJECT NO.: 20026
SAMPLING TEAM: JM Kuehl/D. Downs/T Puchalski

SAMPLING CONDITIONS

TEMPERATURE: 48 °F – 32 x 5/9 = ______ °C (tA) HNu: 0 ppm
BAROMETRIC PRESSURE (PA): 30.23 mm Hg at 1215 AM/PM H2S: 0 ppm
RELATIVE HUMIDITY: 92 % CH4: 0 % LEL
WIND: 0 mph from ______
WEATHER: Sun setting

SAMPLE GRID COORDINATES.: ______ N ______ E I-22
SAMPLING INTERVAL: 3.00 ft
SOIL CONDITIONS AT SURFACE: old road - sand near asphalt piles

PUMP CALIBRATION

PUMP MFG/MODEL/SN: Gilian / Gilair / ~~251222~~ unk 2196
CALIBRATOR MFG/MODEL/SN: Ezcal / Sensidyne / 251222
INITIAL CALIBRATION (QA) TO $\bar{x}$=4.17 (n=7) L/MIN AT TIME: 0530
CALIBRATION VERIFICATION: ROTAMETER READING 4.0 TIME: 1545
*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE ROTAMETER READING 4.0 TIME: 1620
% DIFFERENCE 0

SAMPLE COLLECTION

E-28 Tenax + CHARCOAL TUBE NUMBER: TC35 E-24 unk ~~CHARCOAL~~/TENAX TUBE NUMBER: T3262
STOP TIME: used COLLECTION CONDITIONS:
hole open 1540 START TIME: stopwatch intermittent vacuum conditions
TIME ELAPSED (T) 10.00 MINUTES variable rotameter readings

TOTAL VOLUMETRIC FLOW CALCULATION

Vm = T x QA = 10.00 x 4.17 = 41.7 LITERS (Vm)

$$Vs = Vm \times \frac{PA}{760} \times \frac{298}{273 + tA} = 1.75 \text{ LITERS (Vs)*}$$

*RECORD Vs IN LITERS ON SAS CHAIN OF CUSTODY REMARKS COLUMN.

1700

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

CLIENT: EPA ARCS DATE: 11/2/90 EPA SAS NO.: 5748E E-30

SITE: Himco DONOHUE SPL NO.: HDTT-13

PROJECT NO.: 20026

SAMPLING TEAM: M Kuehl / D Downs / T Puchalski

SAMPLING CONDITIONS

TEMPERATURE: 48 °F – 32 x 5/9 = ______ °C (tA) HNu: 0 ppm

BAROMETRIC PRESSURE (PA): 30.23 mm Hg at 12:15 AM/PM H2S: 0 ppm

RELATIVE HUMIDITY: 92 % CH4: 0 % LEL

WIND: 0 mph from ______

WEATHER: cool, dusk

SAMPLE GRID COORDINATES.: ______ N ______ E I-21

SAMPLING INTERVAL: 3.00 ft

SOIL CONDITIONS AT SURFACE: mounded sand - high point on berm

PUMP CALIBRATION

PUMP MFG/MODEL/SN: Gilian / Gilair / 2196

CALIBRATOR MFG/MODEL/SN: EzCal / Sensidyne / 2512222

INITIAL CALIBRATION (QA) TO ~~4.2~~ $\bar{x}$ = 4.17 (n=7) L/MIN AT TIME: 0530

CALIBRATION VERIFICATION: ROTAMETER READING 4.0 TIME: 1645

*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE ROTAMETER READING 4.0 TIME: 1715

% DIFFERENCE 0

SAMPLE COLLECTION

E-30 TENAX + CHARCOAL TUBE NUMBER: TC3619 E-31 ~~CHARCOAL~~/TENAX TUBE NUMBER: T4723

STOP TIME: ~~used~~ COLLECTION CONDITIONS: intermittent

hole open 1:45 START TIME: stopwatch variable rotameter, suction

TIME ELAPSED (T) 10.01.00 MINUTES created - noted upon sample train removal

TOTAL VOLUMETRIC FLOW CALCULATION

$Vm = T \times QA =$ 10.00 x 4.17 = 41.7 LITERS (Vm)

$Vs = Vm \times \frac{PA}{760} \times \frac{298}{273 + tA} =$ 1.75 LITERS (Vs)*

*RECORD Vs IN LITERS ON SAS CHAIN OF CUSTODY REMARKS COLUMN.

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

0905

CLIENT: EPA ARCS DATE: 11/11/90 EPA SAS NO.: 5743E E-32 33

SITE: Himco DONOHUE SPL NO.: HDTT-14

PROJECT NO.: 20026

SAMPLING TEAM: M. Kuehl / D. Downs / T Puchalski

SAMPLING CONDITIONS

TEMPERATURE: 35 °F − 32 x 5/9 = 1.67 °C (tA) HNu: 0 ppm

BAROMETRIC PRESSURE (PA): 30.20 mm Hg at 0800 AM/PM H_2S: 0 ppm

RELATIVE HUMIDITY: 81 % CH_4: 0 % LEL

WIND: 5-10 mph from SE

WEATHER: sunny mild

SAMPLE GRID COORDINATES.: ______ N ______ E D-24

SAMPLING INTERVAL: 3.0 ft

SOIL CONDITIONS AT SURFACE: Sandy, visible $CaSO_4$

PUMP CALIBRATION

pump cal readings 4.17 4.19 4.2 4.23 4.08 4.16 4.11

PUMP MFG/MODEL/SN: Gilian / Gilair / 2196

CALIBRATOR MFG/MODEL/SN: Ezcal / Sensidyne / 251222

INITIAL CALIBRATION (QA) TO $\bar{x}$ = 4.17 n=7 L/MIN AT TIME: 0600

CALIBRATION VERIFICATION: ROTAMETER READING 4.00 TIME: 0840

*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE

ROTAMETER READING 4.00 TIME: ~~08~~ 0920

% DIFFERENCE 0

SAMPLE COLLECTION

E-32 TENAX + CHARCOAL TUBE NUMBER: TC4648 ~~CHARCOAL~~ E33 TENAX TUBE NUMBER: T4716

STOP TIME: used stop watch COLLECTION CONDITIONS:

START TIME: drilled through waste, 3 distinct

probe open 0945

TIME ELAPSED (T) 10.00 MINUTES "layers" felt during probe insertion

TOTAL VOLUMETRIC FLOW CALCULATION

Vm = T x QA = 10.00 x 4.17 = 41.7 LITERS (Vm)

Vs = Vm x PA (30.20) / 760 x 298 / 273 + tA (1.67) = 1.79 LITERS (Vs)*

*RECORD Vs ~~IN LITERS ON~~ SAS CHAIN OF CUSTODY REMARKS COLUMN.

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

0945

CLIENT: EPA 4205 DATE: 11/1/90 EPA SAS NO.: 5743E E-3

SITE: Himco DONOHUE SPL NO.: HD IT-15

PROJECT NO.: 20026

SAMPLING TEAM: M Kuehl / D Downs / T. Puchalski

SAMPLING CONDITIONS

TEMPERATURE: 35 °F – 32 x 5/9 = 1.67 °C (tA) HNu: 0 ppm

BAROMETRIC PRESSURE (PA): 30.20 mm Hg at 0800 AM/PM H_2S: 0 ppm

RELATIVE HUMIDITY: 81 % CH_4: 0 % LEL

WIND: 5-10 mph from SE

WEATHER: sunny, mild

SAMPLE GRID COORDINATES.: ______ N ______ E F-25

SAMPLING INTERVAL: 3.0 ft

SOIL CONDITIONS AT SURFACE:

PUMP CALIBRATION

PUMP MFG/MODEL/SN: Gilian / Gilair / 2169

CALIBRATOR MFG/MODEL/SN: E2Cal / Sensidyne / 251222

INITIAL CALIBRATION (QA) TO $\bar{X}$=4.17 n=7 L/MIN AT TIME: 0600

CALIBRATION VERIFICATION: ROTAMETER READING 4.00 TIME: 0935

*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE ROTAMETER READING 4.00 TIME: 0955

% DIFFERENCE 0

SAMPLE COLLECTION

E-34 TENAX & CHARCOAL TUBE NUMBER: TC3182 ~~CHARCOAL~~ TENAX TUBE NUMBER: T42 E-35

STOP TIME: used COLLECTION CONDITIONS:

START TIME: stopwatch suction created at 30-60 seconds

TIME ELAPSED (T) 10.00 MINUTES intermittent rotameter variability

hole open 0430 hrs

TOTAL VOLUMETRIC FLOW CALCULATION

Vm = T x QA = 10.00 x 4.17 = 41.7 LITERS (Vm)

$Vs = Vm \times \frac{PA}{760} \times \frac{298}{273 + tA}$ = 1.79 LITERS (Vs)*

*RECORD Vs IN LITERS ON SAS CHAIN OF CUSTODY REMARKS COLUMN.

F/SOIL GAS

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

F025

CLIENT: EPA ACCS DATE: 11/14/90 EPA SAS NO.: 5798E E-36 37

SITE: Hmco DONOHUE SPL NO.: HDTT16

PROJECT NO.: 20026

SAMPLING TEAM: M Kuehl/D Downs/T. Puchalski

SAMPLING CONDITIONS

TEMPERATURE: 35 °F – 32 x 5/9 = 1.67 °C (tA) HNu: 0 ppm

BAROMETRIC PRESSURE (PA): 30.20 mm Hg at 0800 AM/PM H_2S: 0 ppm

RELATIVE HUMIDITY: 81 % CH_4: 0 % LEL

WIND: 5-10 mph from SE

WEATHER: sunny mild

SAMPLE GRID COORDINATES.: ______ N ______ E K-14

SAMPLING INTERVAL: 3.0 ft

SOIL CONDITIONS AT SURFACE: sandy, dead sumac

PUMP CALIBRATION

PUMP MFG/MODEL/SN: Gilian / Gilair / 2196

CALIBRATOR MFG/MODEL/SN: Gilcal / Sensidyne / 251222

INITIAL CALIBRATION (QA) TO $\bar{x}$=4.17 n=7 L/MIN AT TIME: 0600

CALIBRATION VERIFICATION: ROTAMETER READING 4.00 TIME: 1005

*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE ROTAMETER READING 4.00 TIME: 1035

% DIFFERENCE 0

SAMPLE COLLECTION

E-36 TENAX & CHARCOAL TUBE NUMBER: TC4126 ~~CHARCOAL~~ mm E-37 TENAX TUBE NUMBER: T4727

STOP TIME: used stopwatch COLLECTION CONDITIONS: suction created, intermittent variable rotameter readings

START TIME:

TIME ELAPSED (T) 10.00 MINUTES

hole open 1010

TOTAL VOLUMETRIC FLOW CALCULATION

Vm = T x QA = 10.00 x 4.17 = 41.7 LITERS (Vm)

$Vs = Vm \times \frac{PA}{760} \times \frac{298}{273 + tA}$ = 1.79 LITERS (Vs)*

*RECORD Vs IN LITERS ON SAS CHAIN OF CUSTODY REMARKS COLUMN.

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

1040

CLIENT: EPA ARCS DATE: 11/14/90 EPA SAS NO.: 5793E E-38

SITE: Hinco DONOHUE SPL NO.: HD FD TT16

PROJECT NO.: 20026

SAMPLING TEAM: M Kuehl / D Downs / T. Puchalski

SAMPLING CONDITIONS

TEMPERATURE: 35 °F – 32 x 5/9 = 1.67 °C (tA) HNu: 0 ppm

BAROMETRIC PRESSURE (PA): 30.20 mm Hg at 0800 AM/PM H2S: 0 ppm

RELATIVE HUMIDITY: 91 % CH4: 0 % LEL

WIND: 5-10 mph from SE

WEATHER: Sunny mild

SAMPLE GRID COORDINATES.: ______ N ______ E K-14

SAMPLING INTERVAL: 3.0 ft

SOIL CONDITIONS AT SURFACE: Sandy, dead sumac

PUMP CALIBRATION

PUMP MFG/MODEL/SN: Gilian / Gilair / 2196

CALIBRATOR MFG/MODEL/SN: Dcal / Sensidyne / 1251222

INITIAL CALIBRATION (QA) TO $\bar{X}$=4.17 n=7 L/MIN AT TIME: 0600

CALIBRATION VERIFICATION: ROTAMETER READING 4.00 TIME: 0835

*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE ROTAMETER READING 4.00 TIME: 1100

% DIFFERENCE 0

SAMPLE COLLECTION

E-38 TENAX & CHARCOAL TUBE NUMBER: TC4742 ~~man~~ E-39 ~~CHARCOAL~~/TENAX TUBE NUMBER: T4698

STOP TIME: used stopwatch COLLECTION CONDITIONS: field dup at hole TT16

START TIME:

TIME ELAPSED (T) 10.00 MINUTES

TOTAL VOLUMETRIC FLOW CALCULATION

Vm = T x QA = ~~[illegible]~~ 10.00 x 4.17 = 41.7 LITERS (Vm)

Vs = Vm x $\frac{PA}{760}$ x $\frac{298}{273 + tA}$ = 1.74 LITERS (Vs)*

*RECORD Vs IN LITERS ON SAS CHAIN OF CUSTODY REMARKS COLUMN.

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

CLIENT: E.PA ARCS DATE: 11/14 EPA SAS NO.: 5798E E-40 (

SITE: Himco DONOHUE SPL NO.: HD MS01

PROJECT NO.: 20026

SAMPLING TEAM: M Kuehl

SAMPLING CONDITIONS

TEMPERATURE: ____ °F − 32 x 5/9 = ____ °C (tA) HNu: ____ ppm

BAROMETRIC PRESSURE (PA): ____ mm Hg at ____ AM/PM H_2S: ____ ppm

RELATIVE HUMIDITY: ____ % CH_4: ____ % LEL

WIND: ____ mph from ____ not applicable

WEATHER: ____

SAMPLE GRID COORDINATES.: ____ N ____ E

SAMPLING INTERVAL: ____ ft

SOIL CONDITIONS AT SURFACE: ____

PUMP CALIBRATION not applicable

PUMP MFG/MODEL/SN: ____

CALIBRATOR MFG/MODEL/SN: ____

INITIAL CALIBRATION (QA) TO ____ L/MIN AT TIME: ____

CALIBRATION VERIFICATION: ROTAMETER READING ____ TIME: ____

*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE ROTAMETER READING ____ TIME: ____

% DIFFERENCE ____

SAMPLE COLLECTION

E-40 TENAX & CHARCOAL TUBE NUMBER: TC4484 E-41 ~~CHARCOAL~~/TENAX TUBE NUMBER: T4717

STOP TIME: ____ COLLECTION CONDITIONS: ____

START TIME: not applicable matrix spike

TIME ELAPSED (T) ____ MINUTES Unexposed tubes

TOTAL VOLUMETRIC FLOW CALCULATION

$V_m = T \times QA =$ ____ x ____ = LITERS (V_m) not applicable

$V_s = V_m \times \frac{PA}{760} \times \frac{298}{273 + t_A} =$ ____ LITERS (V_s)*

*RECORD Vs IN LITERS ON SAS CHAIN OF CUSTODY REMARKS COLUMN.

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

CLIENT: EPA ARCS DATE: 11/14/90 EPA SAS NO.: 5798E E-4. 4

SITE: Hmw DONOHUE SPL NO.: HD IT MSD01

PROJECT NO.: 20026

SAMPLING TEAM: M Kuehl

SAMPLING CONDITIONS

TEMPERATURE: ______ °F − 32 x 5/9 = ______ °C (tA) HNu: ______ ppm

BAROMETRIC PRESSURE (PA): ______ mm Hg at ______ AM/PM H_2S: ______ ppm

RELATIVE HUMIDITY: ______ % CH_4: ______ % LEL

WIND: ______ mph from ______ not applicable

WEATHER: ______

SAMPLE GRID COORDINATES.: ______ N ______ E

SAMPLING INTERVAL: ______ ft

SOIL CONDITIONS AT SURFACE: ______

PUMP CALIBRATION

PUMP MFG/MODEL/SN: not applicable

CALIBRATOR MFG/MODEL/SN: ______

INITIAL CALIBRATION (QA) TO ______ L/MIN AT TIME: ______

CALIBRATION VERIFICATION: ROTAMETER READING ______ TIME: ______

*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE ROTAMETER READING ______ TIME: ______

% DIFFERENCE ______

SAMPLE COLLECTION

E-42 CHARCOAL TUBE NUMBER: TC 4735 E-43 ~~CHARCOAL~~/TENAX TUBE NUMBER: T4673

STOP TIME: not applicable COLLECTION CONDITIONS: ______

START TIME: ______ matrix spike duplicate

TIME ELAPSED (T) ______ MINUTES unexposed tubes

TOTAL VOLUMETRIC FLOW CALCULATION

$Vm = T \times QA =$ ______ x ______ = LITERS (Vm) not applicable

$Vs = Vm \times \frac{PA}{760} \times \frac{298}{273 + tA} =$ ______ LITERS (Vs)*

*RECORD Vs IN LITERS ON SAS CHAIN OF COUSTODY REMARKS COLUMN.

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

CLIENT: EPA ARCS DATE: 11/14/90 EPA SAS NO.: 5793E E-44

SITE: HmCo DONOHUE SPL NO.: HD TT 4502

PROJECT NO.: 20026

SAMPLING TEAM: M Kuehl

SAMPLING CONDITIONS

TEMPERATURE: ______ °F – 32 x 5/9 = ______ °C (tA) HNu: ______ ppm

BAROMETRIC PRESSURE (P_A): ______ mm Hg at ______ AM/PM H_2S: ______ ppm

RELATIVE HUMIDITY: ______ % CH_4: ______ % LEL

WIND: ______ mph from ______ not applicable

WEATHER: ______

SAMPLE GRID COORDINATES.: ______ N ______ E

SAMPLING INTERVAL: ______ ft

SOIL CONDITIONS AT SURFACE: ______

PUMP CALIBRATION

PUMP MFG/MODEL/SN: not applicable

CALIBRATOR MFG/MODEL/SN: ______

INITIAL CALIBRATION (Q_A) TO ______ L/MIN AT TIME: ______

CALIBRATION VERIFICATION: ROTAMETER READING ______ TIME: ______

*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE ROTAMETER READING ______ TIME: ______

% DIFFERENCE ______

SAMPLE COLLECTION

E-44 CHARCOAL TUBE NUMBER: TC3143 E-45 ~~CHARCOAL~~/TENAX TUBE NUMBER: T4715

STOP TIME: ______ COLLECTION CONDITIONS: ______

START TIME: not applicable matrix spike

TIME ELAPSED (T) ______ MINUTES unexposed tubes

TOTAL VOLUMETRIC FLOW CALCULATION

$V_m = T \times Q_A =$ ______ x ______ = ______ LITERS (V_m)

$V_s = V_m \times \frac{P_A}{760} \times \frac{298}{273 + t_A} =$ ______ LITERS (V_s)* not applicable

*RECORD Vs IN LITERS ON SAS CHAIN OF CUSTODY REMARKS COLUMN.

Donohue ENGINEERS ARCHITECTS SCIENTISTS

SOIL GAS SURVEY FORM

CLIENT: EPA ARCS DATE: 11/14/90 EPA SAS NO.: 5793E E-4

SITE: Hmco DONOHUE SPL NO.: HD TI MSD02

PROJECT NO.: 20026

SAMPLING TEAM: M. Kuehl

SAMPLING CONDITIONS

TEMPERATURE: ______ °F − 32 x 5/9 = ______ °C (tA) HNu: ______ ppm

BAROMETRIC PRESSURE (PA): ______ mm Hg at ______ AM/PM H2S: ______ ppm

RELATIVE HUMIDITY: ______ % CH4: ______ % LEL

WIND: ______ mph from ______

not applicable

WEATHER: ______

SAMPLE GRID COORDINATES.: ______ N ______ E

SAMPLING INTERVAL: ______ ft

SOIL CONDITIONS AT SURFACE: ______

PUMP CALIBRATION

PUMP MFG/MODEL/SN: ______ not applicable

CALIBRATOR MFG/MODEL/SN: ______

INITIAL CALIBRATION (QA) TO ______ L/MIN AT TIME: ______

CALIBRATION VERIFICATION: ROTAMETER READING ______ TIME: ______

*IF > 10%, SAMPLE TUBES SUSPECT, RESAMPLE ROTAMETER READING ______ TIME: ______

% DIFFERENCE ______ *

SAMPLE COLLECTION

E-46 CHARCOAL TUBE NUMBER: TC4141 MK E-47 ~~CHARCOAL~~ TENAX TUBE NUMBER: T4694

STOP TIME: ______ COLLECTION CONDITIONS: ______

START TIME: ______ not applicable matrix spike duplicates

TIME ELAPSED (T) ______ MINUTES unexposed tubes

TOTAL VOLUMETRIC FLOW CALCULATION

$V_m = T \times QA =$ ______ x ______ = ______ LITERS (Vm)

$V_s = V_m \times \frac{PA}{760} \times \frac{298}{273 + t_A} =$ ______ LITERS (Vs)* not applicable

*RECORD Vs IN LITERS ON SAS CHAIN OF CUSTODY REMARKS COLUMN.

ATTACHMENT C

LABORATORY RESULTS
FIELD TRIAL SAMPLES

Transmission from:

ITAS - Cincinnati
11499 Chester Road
Cincinnati, Ohio 45246

FAX # (513) 782-4644

Voice # (513) 782-4600

From: PATRICK FARRELL

Department: GC/MS

To: CHARLENE KHAZAE / [redacted]

Company: DONAHUE & ASSOCIATES

Department:

FAX #: 1-414-458-0550

Voice #:

Special Instructions/Comments:

FORM 1A & 1E FOR SAS PROJECT #5798-E
FOR FURTHER INFO CONTACT PATRICK FARRELL
@ 513-782-4805

Disposition of Original: ○ Return to Originator ○ Discard

Total Number of Pages including this cover sheet: 9 **FAX Operator:** [illegible]

VOLATILE ORGANICS ANALYSIS DATA SHEET

HDTTC1-01

LAB NAME: PEI ASSOCIATES

CONTRACT: SAS 5798-E | 5798E-1 / 5798E-2

SAMPLE MATRIX: TENAX

LAB SAMPLE ID: XO-11-064-01A

SAMPLE WT/VOL: NA

LAB FILE ID: 5798-E1

LEVEL (low/med) LOW

DATE RECEIVED: 11/8/90

% MOISTURE: not dec. NA

DATE ANALYZED: 11/8/90

DILUTION FACTOR: 1

CONCENTRATION UNITS: NG/L ~~NG-OE~~

CAS NO.	COMPOUND		DET. LIMIT	Q
74-87-3	CHLOROMETHANE		3 ~~10~~	U
74-83-9	BROMOMETHANE		3 ~~10~~	U
75-01-4	VINYL CHLORIDE		3 ~~10~~	U
75-00-3	CHLOROETHANE		3 ~~10~~	U
75-09-2	METHYLENE CHLORIDE	~~8~~ 3	~~5~~	B
67-64-1	ACETONE	~~16~~ 5	~~10~~	
75-15-0	CARBON DISULFIDE		2 ~~5~~	U
75-35-4	1,1-DICHLOROETHENE		2 ~~5~~	U
75-34-3	1,1-DICHLOROETHANE		2 ~~5~~	U
540-59-0	1,2-DICHLOROETHENE (TOTAL)		2 ~~5~~	U
67-66-3	CHLOROFORM		2 ~~5~~	U
107-06-2	1,2-DICHLOROETHANE		2 ~~5~~	U
78-93-3	2-BUTANONE		3 ~~10~~	U
71-55-6	1,1,1-TRICHLOROETHANE		2 ~~5~~	U
56-23-5	CARBON TETRACHLORIDE		2 ~~5~~	U
108-05-4	VINYL ACETATE		2 ~~10~~	U
75-27-4	BROMODICHLOROMETHANE		2 ~~5~~	U
78-87-5	1,2-DICHLOROPROPANE		2 ~~5~~	U
10061-01-5	cis-1,3-DICHLOROPROPENE		2 ~~5~~	U
79-01-6	TRICHLOROETHENE		2 ~~5~~	U
124-48-1	DIBROMOCHLOROMETHANE		2 ~~5~~	U
79-00-5	1,1,2-TRICHLOROETHANE		2 ~~5~~	U
71-43-2	BENZENE	~~2~~ 1	~~5~~	J
10061-02-6	trans-1,3-DICHLOROPROPENE		2 ~~5~~	U
75-25-2	BROMOFORM		2 ~~5~~	U
108-10-1	4-METHYL-2-PENTANONE		3 ~~10~~	U
591-78-6	2-HEXANONE		3 ~~10~~	U
127-18-4	TETRACHLOROETHENE		2 ~~5~~	U
79-34-5	1,1,2,2-TETRACHLOROETHANE		2 ~~5~~	U
108-88-3	TOLUENE	~~72~~ 24	~~5~~	
108-90-7	CHLOROBENZENE		2 ~~5~~	U
100-41-4	ETHYL BENZENE		2 ~~5~~	U
100-42-5	STYRENE		2 ~~5~~	U
1330-20-7	XYLENE (TOTAL)		2 ~~5~~	U

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENATIVELY IDENTIFIED COMPOUNDS

HDTT01-01

LAB NAME: PEI ASSOCIATES

CONTRACT: SAS 5798-E | 5798-E1 / 5798-E2

SAMPLE MATRIX: TENAX

LAB SAMPLE ID: XO-11-064-01A

SAMPLE WT/VOL: NA

LAB FILE ID: 5798-E1

LEVEL (low/med): LOW

DATE RECIEVED: 11/8/90

% MOISTURE: not dec. NA

DATE ANALYZED: 11/8/90

DILUTION FACTOR: 1

NUMBER OF TIC'S FOUND: 2

CONCENTRATION UNITS: NG/L

CAS NUMBER	COMPOUND NAME	RET. TIME	~~NG-0C~~	Q
76-13-1	112-TRICHLORO-122-TRIFLUOROETHANE	9:22	20 ~~60~~	J
	UNKNOWN HYDROCARBON	11:26	3 ~~10~~	J

FORM 1E VOA-TIC

HOTTO2-51

VOLATILE ORGANICS ANALYSIS DATA SHEET

LAB NAME. PEI ASSOCIATES

CONTRACT: SAS 5798-E | 5798E-3 / 5798E-4

SAMPLE MATRIX: TENAX

LAB SAMPLE ID: XO-11-064-02A

SAMPLE WT/VOL: NA

LAB FILE ID: 5798-E3

LEVEL:(low/med) LOW

DATE RECIEVED: 11/8/90

% MOISTURE: not dec. NA

DATE ANALYZED: 11/8/90

DILUTION FACTOR: 1

CONCENTRATION UNITS: NG/L ~~NG-DC~~

CAS NO.	COMPOUND		DET. LIMIT	Q
74-87-3	CHLOROMETHANE		5 ~~10~~	U
74-83-9	BROMOMETHANE		5 ~~10~~	U
75-01-4	VINYL CHLORIDE		5 ~~10~~	U
75-00-3	CHLOROETHANE		5 ~~10~~	U
75-09-2	METHYLENE CHLORIDE	~~17~~ 8	~~5~~	B
67-64-1	ACETONE	~~18~~ 8	~~10~~	
75-15-0	CARBON DISULFIDE	~~7~~ 3	~~5~~	
75-35-4	1,1-DICHLOROETHENE		2 ~~5~~	U
75-34-3	1,1-DICHLOROETHANE		2 ~~5~~	U
540-59-0	1,2-DICHLOROETHENE (TOTAL)		2 ~~5~~	U
67-66-3	CHLOROFORM		2 ~~5~~	U
107-06-2	1,2-DICHLOROETHANE		2 ~~5~~	U
78-93-3	2-BUTANONE		5 ~~10~~	U
71-55-6	1,1,1-TRICHLOROETHANE	~~8~~ 2	~~5~~	
56-23-5	CARBON TETRACHLORIDE		2 ~~5~~	U
108-05-4	VINYL ACETATE		5 ~~10~~	U
75-27-4	BROMODICHLOROMETHANE		2 ~~5~~	U
78-87-5	1,2-DICHLOROPROPANE		2 ~~5~~	U
10061-01-5	cis-1,3-DICHLOROPROPENE		2 ~~5~~	U
79-01-6	TRICHLOROETHENE		2 ~~5~~	U
124-48-1	DIBROMOCHLOROMETHANE		2 ~~5~~	U
79-00-5	1,1,2-TRICHLOROETHANE		2 ~~5~~	U
71-43-2	BENZENE	~~4~~ 2	~~5~~	J
10061-02-6	trans-1,3-DICHLOROPROPENE		2 ~~5~~	U
75-25-2	BROMOFORM		2 ~~5~~	U
108-10-1	4-METHYL-2-PENTANONE		5 ~~10~~	U
591-78-6	2-HEXANONE		5 ~~10~~	U
127-18-4	TETRACHLOROETHENE		2 ~~5~~	U
79-34-5	1,1,2,2-TETRACHLOROETHANE		2 ~~5~~	U
108-88-3	TOLUENE	~~67~~ 31	~~5~~	
108-90-7	CHLOROBENZENE		2 ~~5~~	U
100-41-4	ETHYL BENZENE		2 ~~5~~	U
100-42-5	STYRENE		2 ~~5~~	U
1330-20-7	XYLENE (TOTAL)		2 ~~5~~	U

HDTT02-01

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENATIVELY IDENTIFIED COMPOUNDS

LAB NAME: PEI ASSOCIATES

CONTRACT: SAS 5798-E 5798-E3 / 5798-E4

SAMPLE MATRIX: TENAX

LAB SAMPLE ID: XO-11-064-02A

SAMPLE WT/VOL: NA

LAB FILE ID: 5798-E3

LEVEL:(low/med) LOW

DATE RECEIVED: 11/8/90

% MOISTURE: not dec. NA

DATE ANALYZED: 11/8/90

DILUTION FACTOR: 1

NUMBER OF TIC'S FOUND: 3

CONCENTRATION UNITS: NG/L

CAS NUMBER	COMPOUND NAME	RET. TIME	~~NG-OG-~~	Q
76-13-1	112-TRICHLORO-122-TRIFLUOROETHANE	9:18	100 ~~300~~	J
	UNKNOWN HYDROCARBON	11:22	10 ~~20~~	J
	UNKNOWN HYDROCARBON	16:22	4 ~~8~~	J

HDTT03-01

VOLATILE ORGANICS ANALYSIS DATA SHEET

LAB NAME: PEI ASSOCIATES

CONTRACT: ~~SAS 5798-E~~ 5798E-5 / 5798E-6

SAMPLE MATRIX: TENAX

LAB SAMPLE ID: X0-11-064-03A

SAMPLE WT/VOL: NA

LAB FILE ID: 5798-E5

LEVEL (low/med) LOW

DATE RECEIVED: 11/8/90

% MOISTURE: not dec. NA

DATE ANALYZED: 11/8/90

DILUTION FACTOR: 1

CONCENTRATION UNITS: NG/L

CAS NO.	COMPOUND	~~NG/L~~	DET. LIMIT	Q
74-87-3	CHLOROMETHANE		11 ~~10~~	U
74-83-9	BROMOMETHANE		11 ~~10~~	U
75-01-4	VINYL CHLORIDE		11 ~~10~~	U
75-00-3	CHLOROETHANE		11 ~~10~~	U
75-09-2	METHYLENE CHLORIDE	~~13~~ 16	~~5~~	B
67-64-1	ACETONE	~~16~~ 18	~~10~~	
75-15-0	CARBON DISULFIDE		6 ~~5~~	U
75-35-4	1,1-DICHLOROETHENE		6 ~~5~~	U
75-34-3	1,1-DICHLOROETHANE		6 ~~5~~	U
540-59-0	1,2-DICHLOROETHENE (TOTAL)		6 ~~5~~	U
67-66-3	CHLOROFORM		6 ~~5~~	U
107-06-2	1,2-DICHLOROETHANE		6 ~~5~~	U
78-93-3	2-BUTANONE		11 ~~10~~	U
71-55-6	1,1,1-TRICHLOROETHANE		6 ~~5~~	U
56-23-5	CARBON TETRACHLORIDE		6 ~~5~~	U
108-05-4	VINYL ACETATE		11 ~~10~~	U
75-27-4	BROMODICHLOROMETHANE		6 ~~5~~	U
78-87-5	1,2-DICHLOROPROPANE		6 ~~5~~	U
10061-01-5	cis-1,3-DICHLOROPROPENE		6 ~~5~~	U
79-01-6	TRICHLOROETHENE		6 ~~5~~	U
124-48-1	DIBROMOCHLOROMETHANE		6 ~~5~~	U
79-00-5	1,1,2-TRICHLOROETHANE		6 ~~5~~	U
71-43-2	BENZENE	2	~~5~~	J
10061-02-6	trans-1,3-DICHLOROPROPENE		6 ~~5~~	U
75-25-2	BROMOFORM		6 ~~5~~	U
108-10-1	4-METHYL-2-PENTANONE		11 ~~10~~	U
591-78-6	2-HEXANONE		11 10	U
127-18-4	TETRACHLOROETHENE		6 ~~5~~	U
79-34-5	1,1,2,2-TETRACHLOROETHANE		6 ~~5~~	U
108-88-3	TOLUENE	~~19~~ 21	~~5~~	
108-90-7	CHLOROBENZENE		6 ~~5~~	U
100-41-4	ETHYL BENZENE		6 ~~5~~	U
100-42-5	STYRENE		6 ~~5~~	U
1330-20-7	XYLENE (TOTAL)		6 ~~5~~	U

FORM 1 A VOA

HDTT03-01

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENATIVELY IDENTIFIED COMPOUNDS

LAB NAME: PEI ASSOCIATES

CONTRACT: SAS 5798-E 5798-E5 / 5798-E6

SAMPLE MATRIX: TENAX

LAB SAMPLE ID: XO-11-064-03A

SAMPLE WT/VOL: NA

LAB FILE ID: 5798-E5

LEVEL (low/med) LOW

DATE RECEIVED: 11/8/90

% MOISTURE: not dec. NA

DATE ANALYZED: 11/8/90

DILUTION FACTOR: 1

NUMBER OF TIC'S FOUND: 1

CONCENTRATION UNITS: NG/L

CAS NUMBER	COMPOUND NAME	RET. TIME	~~NG-ØC~~	Q
76-13-1	112-TRICHLORO-122-TRIFLUOROETHANE	9:20	200	J

VOLATILE ORGANICS ANALYSIS DATA SHEET

LAB NAME: PEI ASSOCIATES

CONTRACT: SAS 5798-E

VBLKACO

SAMPLE MATRIX: TENAX

LAB SAMPLE ID: VBLKACO

SAMPLE WT/VOL: NA

LAB FILE ID: VBLKACO

LEVEL (low/med) LOW

DATE RECEIVED: 11/8/90

% MOISTURE: not dec. NA

DATE ANALYZED: 11/8/90

DILUTION FACTOR: 1

CONCENTRATION UNITS: NG_OC

CAS NO.	COMPOUND		DET. LIMIT	Q
74-87-3	CHLOROMETHANE		10	U
74-83-9	BROMOMETHANE		10	U
75-01-4	VINYL CHLORIDE		10	U
75-00-3	CHLOROETHANE		10	U
75-09-2	METHYLENE CHLORIDE	10	5	
67-64-1	ACETONE		10	U
75-15-0	CARBON DISULFIDE		5	U
75-35-4	1,1-DICHLOROETHENE		5	U
75-34-3	1,1-DICHLOROETHANE		5	U
540-59-0	1,2-DICHLOROETHENE (TOTAL)		5	U
67-66-3	CHLOROFORM		5	U
107-06-2	1,2-DICHLOROETHANE		5	U
78-93-3	2-BUTANONE	13	10	
71-55-6	1,1,1-TRICHLOROETHANE		5	U
56-23-5	CARBON TETRACHLORIDE		5	U
108-05-4	VINYL ACETATE		10	U
75-27-4	BROMODICHLOROMETHANE		5	U
78-87-5	1,2-DICHLOROPROPANE		5	U
10061-01-5	cis-1,3-DICHLOROPROPENE		5	U
79-01-6	TRICHLOROETHENE		5	U
124-48-1	DIBROMOCHLOROMETHANE		5	U
79-00-5	1,1,2-TRICHLOROETHANE		5	U
71-43-2	BENZENE		5	U
10061-02-6	trans-1,3-DICHLOROPROPENE		5	U
75-25-2	BROMOFORM		5	U
108-10-1	4-METHYL-2-PENTANONE	17	10	
591-78-6	2-HEXANONE	39	10	
127-18-4	TETRACHLOROETHENE		5	U
79-34-5	1,1,2,2-TETRACHLOROETHANE		5	U
108-88-3	TOLUENE		5	U
108-90-7	CHLOROBENZENE		5	U
100-41-4	ETHYL BENZENE		5	U
100-42-5	STYRENE		5	U
1330-20-7	XYLENE (TOTAL)		5	U

FORM 1 A VOA

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENATIVELY IDENTIFIED COMPOUNDS

VBLKACO

LAB NAME: PEI ASSOCIATES

CONTRACT: SAS 5798-E

SAMPLE MATRIX: TENAX

LAB SAMPLE ID: VBLKACO

SAMPLE WT/VOL: NA

LAB FILE ID: VBLKACO

LEVEL (low/med) LOW

DATE RECEIVED: 11/8/90

% MOISTURE: not dec. NA

DATE ANALYZED: 11/8/90

DILUTION FACTOR: 1

NUMBER OF TIC'S FOUND: 0

CONCENTRATION UNITS:

CAS NUMBER	COMPOUND NAME	RET. TIME	NG OC	Q

FORM 1E VOA-TIC

T M No. 13

MEMORANDUM

DATE: December 10, 1990

TO: Vanessa Harris
Project Files, Himco Dump Site

PRELIMINARY

CC: M. Kuehl - RI Lead
R. Gau - Project Manager
M. Crosser - TSQAM

FROM: Rob Cannestra, Hydrogeologist

SUBJECT: EPA ARCS Region V Contract No. 68-W8-9003
EPA Work Assignment No. 17-5L4J
Donohue Project No. 20026.024
Himco Dump RI/FS

INSTALLATION OF WATER TABLE WELLS AND LANDFILL CAP SAMPLING

Introduction

Six shallow observations wells were installed on or adjacent to the Himco Dump site between the dates of November 5, 1990, and November 14, 1990. Water table observation wells were installed to obtain water elevation information and to allow for groundwater sampling. Tasks associated with the installation of these wells included logging and classification of continuously sampled soils, field screening of soil samples, collection of soil samples for chemical and geotechnical analysis, and well installation. In addition, geotechnical samples were taken from five locations on the landfill cap. Landfill cap samples were collected for testing to determine the engineering properties of the cap. The following text summarizes the methods and procedures used to complete these tasks and points out deviations from procedures written in the Field Sampling Plan (FSP) or drilling specifications.

Drilling and Sampling

Soil borings BRG-1 through BRG-6 were advanced using hollow stem auger techniques. The subcontractor, John Mathes and Associates (Mathes), used a Central Mine Equipment (CME) 550 ATV rig equipped with 4.25 inch ID (8.0 inch OD) hollow-stem augers to complete these borings. All borings were continuously sampled from ground surface to total depth using a 3 inch OD stainless steel split spoon sampler. Two stainless steel split spoon samplers were used. Split spoon samplers were decontaminated between sampling intervals according to the following steps: (1) tap water rinse, (2) alconox wash, (3) tap water rinse, (4) isopropanol rinse, (5) two deionized water rinses.

At each location, borings were drilled and sampled to a depth of 16.0 feet to allow the well screen to be installed intersecting the water table. All borings were extended a nominal 1 foot by blind drilling with the hollow stem augers. The extension of borings was completed to accommodate any formation collapse during monitoring well installation. After completing a well installation the drill rig and drilling tools were steam cleaned before proceeding to the next installation.

Field Screening and Logging of Soil Samples

After recovering the split spoon and immediately upon opening the sampler barrel, soil samples were field screened by slowly running an HNu photoionization detector (PID) over the length of the sample. The highest PID reading observed for each sample interval was recorded on the boring log.

After field screening, samples were collected for volatile organic compound (VOC) and other chemical analyses. Samples were logged by recording the attempted sample interval, sample length recovered, blow counts, and providing a visual description of the soil. Sample descriptions included the sample color (reference Munsell color chart), relative density, major and minor soil components, general engineering properties and references to the depositional environment. Based on these observations, soils were classified according to the Unified Soil Classification System (USCS). Completed soil boring logs are attached in Appendix A.

Sample Collection

Samples were collected for chemical and geotechnical analysis. Chemical sampling included samples for VOC, base neutrals (BNA), polychlorinated biphenyl (PCBs), cyanide and metals analysis. Geotechnical sampling included samples for Total Organic Carbon (TOC), Atterberg limits and grain size analyses. Samples collected during the completion of borings for water table well installations are summarized in Table 1.

Chemical Sampling

VOC samples were collected immediately after field screening the split spoon. Two 120 ml. jars were filled with soil taken over the entire length of the recovered sample for VOC analysis. After filling the VOC sample jars the remaining soil was emptied into a stainless steel mixing bowl and mixed with a stainless steel spoon. After mixing, two 8 oz. composite samples were taken of the homogenous soil mixture for BNA, PCB, and metals analyses. The sample mixing bowl and spoon were decontaminated between samples by the same method as the split spoon samplers.

According to the Work Plan, chemical samples were to be taken from the first five (5) split spoons (upper 10 feet) at each shallow well location. However, elevated PID readings, peculiar odors or visual signs of contaminations required the collection of samples at depths below 10 feet. In these cases, the additional deeper samples were substituted for shallower samples displaying no signs of contamination. Potentially contaminated samples were collected below 10 foot depths in borings BRG-01, BRG-03, BRG-05, and BRG-06.

TABLE 1

RECORD OF COLLECTED SOIL SAMPLES
WATER TABLE WELL BORINGS
Himco Dump Site
December, 1990

		CHEMICAL SAMPLING				GEOTECHNICAL SAMPLING		
Boring	Depth Interval (Feet)	VOCs	BNA/PCB Pesticides	Metals Cyanide	Duplicate	TOC	Atterberg Limits	Grain Size
BRG-01	0-2	X	X	X		X		
	2-4	X	X	X				
	4-6	X	X	X				
	6-8	X	X	X	X			
	10-12	X	X	X				
	14-16						X	X
BRG-02	0-2	X	X	X				
	2-4	X	X	X		X		
	4-6	X	X	X				
	6-8	X	X	X				
	8-10	X	X	X				
	14-16						X	X
BRG-03	0-2	X	X	X				
	2-4	X	X	X				
	4-6	X	X	X	X			
	6-8	X	X	X				
	8-10					X		
	14-16	X	X	X			X	X
BRG-04	0-2	X	X	X				
	2-4	X	X					
	4-6	X	X	X				
	6-8	X	X	X				
	8-10	X	X	X				
	14-16						X	X

TABLE 1

RECORD OF COLLECTED SOIL SAMPLES
WATER TABLE WELL BORINGS
Himco Dump Site
December, 1990
(continued)

Boring	Depth Interval (Feet)	CHEMICAL SAMPLING VOCs	BNA/PCB Pesticides	Metals Cyanide	Duplicate	GEOTECHNICAL SAMPLING TOC	Atterberg Limits	Grain Size
BRG-05	2-4	X	X	X	X			
	8-10	X	X	X				
	10-12	X	X	X				
	12-14	X	X	X				
	14-16	X	X	X		X	X	X
BRG-06	0-2	X	X	X				
	4-6	X	X	X				
	6-8					X	X	X
	8-10	X	X	X				
	12-14	X	X	X				
	14-16	X	X	X				

W/A/AG7

Geotechnical Samples

Geotechnical samples were collected randomly from borings completed for the installation of shallow observation wells. With the exception of boring BRG-06 samples for Atterberg limits and grain size analysis were taken in the interval to be screened during the well installation. Samples for Total Organic Carbon (TOC) analysis were not collected from every boring completed for the installation of shallow observation wells.

Geotechnical samples were collected after retrieval of chemical samples from the remaining composited soil. One 8 oz. jar was collected for Atterberg limit and grain size analysis. An additional 8 oz. jar sample was taken for TOC analysis when applicable.

All samples were labelled, packaged, and shipped according to the details of the field sampling plan. The site sample custodian completed the appropriate chain-of-custody documentation. Samples were shipped to the appropriate labs by Federal Express.

Well Installations

Shallow observation wells W-101A through W-106A were installed to intersect the water table. Observations made during the drilling and sampling of borings completed for the installation of wells were used to determine the depth to the water table. Because of the shallow water table encountered, modifications were made to the general well specifications to ensure that the well screens intersected the water table. Table 2 summarizes well construction information and general well information for water table observation wells at the Himco Dump site. Well construction diagrams are included in Appendix B.

Wells were constructed using Schedule 5, Type 304, flush threaded stainless steel riser attached to 10-foot, continuous wire wrap, 0.010-inch slot, stainless steel screens. Stainless steel screens and riser were manufactured by Diedrich. Well screens and riser were steam cleaned immediately proceeding installation, handled only while wearing clean latex gloves, and wrapped in protective plastic during transport. All flush threaded joints were wrapped with teflon tape to provide a tight seal. A concentrated effort was made to assure that well construction materials were not contaminated during handling or installation.

In general, observation wells were installed to depths of approximately 16 feet rather than the anticipated 20 feet. To allow for the installation of a 10-foot screen in these shallower borings, the thickness of the filter pack overlying the screen, bentonite seal, and concrete cap were decreased. In the modified well installations, filter packs were extended from 0.3 (WT-105A) to 1.2 (WT-101A) feet above the top of the well screen. Bentonite pellet seals were cut to a nominal 1.0 foot thickness rather than the specified 2.0 feet. The accuracy of measured depths was assured by the shallowness of these installations.

TABLE 2

WATER TABLE OBSERVATION WELL INFORMATION
Himco Dump Site
December, 1990

Well Number	State Plane Coordinates North	State Plane Coordinates East	Top of Pipe Elevation	Screen Length (Feet)	Depth to Bottom of Well (Feet)	Depth to Bottom of Boring (Feet)	Depth to Bottom of Bentonite Seal (Feet)
WT-101A	1,531,617.69	407,617.00	764.35	10	16.3	17.5	4.2
WT-102A	1,534,861.43	405,928.37	769.08	10	16.0	16.8	4.5
WT-103A	1,532,537.90	405,532.73	760.59	10	16.0	17.0	4.0
WT-104A	1,531,496.08	406,013.86	765.57	10	16.3	17.6	4.3
WT-105A	1,531,174.04	407,105.64	762.94	10	16.0	16.8	4.9
WT-106A	1,530,932.11	407,806.75	761.47	10	16.2	17.0	5.0

W/A/AG8

In addition, to facilitate the timely completion of wells, hydration times at several locations were shortened to approximately one-half hour. The integrity of these seals was visually checked prior to the installation of a concrete cap. Finally, concrete cap thickness was reduced from a specified 5.0 feet to a nominal 3.0 foot thickness to accommodate the shallow installations. None of these modifications is expected to adversely effect the performance of these wells.

Despite efforts made to ensure that wells screens intersected the water table, the extremely shallow water table at the location of WT-103A made this impossible. During installation, depth to water in WT-103A was approximately 4.0 feet, placing the water level above the interval to be screened. Temporal fluctuations may cause water levels to decrease, potentially lowering the water level into the screened interval at this location.

Landfill Cap Geotechnical Samples

Geotechnical samples including jar samples for grain size and Atterberg limit testing, and shelby tube samples for consolidation undrained triaxial shear were recovered from five (5) locations on the landfill cap. Landfill cap sample locations varied slightly from those originally specified because they were located at points on the geophysical survey grid rather than the proposed site survey grid. The site survey grid was not completed at the time landfill cap samples were taken. Rather than sample at random or approximate locations on the cap, samples referenced geophysical survey grid points. Landfill cap geotechnical sample locations are included in the site location map (Figure 1).

Landfill cap samples were recovered by digging through the topsoil cover (average thickness approximately 0.5 feet) to the calcium sulfate cap. Once the cap was encountered, excavations were extended by hand to a depth of approximately 1.5 feet. At this depth, two pint size jar samples were collected for grain size and Atterberg limit testing. After collecting jar samples the CME 550 drill rig was used to push 24 inch shelby tubes. The dense nature of the calcium sulfate cap made pushing the tubes difficult. At several locations, shelby tubes appeared to penetrate through the cap material into waste. If shelby tubes potentially encountered waste they were marked as containing potential waste on the tube exterior. Additional shelby tube samples were attempted at two (2) locations for one-dimensional consolidation testing, however, no sample was recovered at one location(adjacent to GE-01). Geotechnical sample holes were backfilled with spoils and hand compacted.

Atmospheric Monitoring

Air quality monitoring within the breathing zone and at the borehole was completed after recovery of the samples. A PID was used to monitor for volatile organic compounds. A GasTech® meter was used to monitor the levels of hydrogen sulfide (H_2S), oxygen, and indicate the percent of the Lower Explosive Limit (LEL) for methane. A miniRAD radiation detector was used to monitor for radioactivity. The highest readings produced by each instrument were recorded in the sections provided on the boring log. During the drilling and sampling of BRG-06, one sampling team member became physically ill while jarring samples from the 12-14 foot depth interval. However, atmospheric monitoring of the borehole and recovered sample did not show any elevated readings at this depth. Atmospheric monitoring results recorded during the completion of borings is included in the completed soil boring logs attached in Appendix A.

Atmospheric monitoring was completed periodically during well installations. Efforts were made to take readings at the beginning of the installation procedure and during the installation as sections of auger were removed from the boring. Atmospheric monitoring during well installations was generally terminated after the installation of the bentonite seal as the boring was then considered effectively plugged off. Results of atmospheric monitoring during well installations were recorded on daily atmospheric monitoring logs attached in Appendix B.

During the recovery of geotechnical samples from the landfill cap atmospheric monitoring was completed as shallow excavations were completed and as shelby tubes were withdrawn. Atmospheric readings taken during geotechnical sampling of the landfill cap were recorded on daily atmospheric monitoring logs attached in Appendix C.

No elevated levels were recorded during atmospheric monitoring conducted during the completion of shallow monitoring wells and landfill cap geotechnical sampling.

SUMMARY

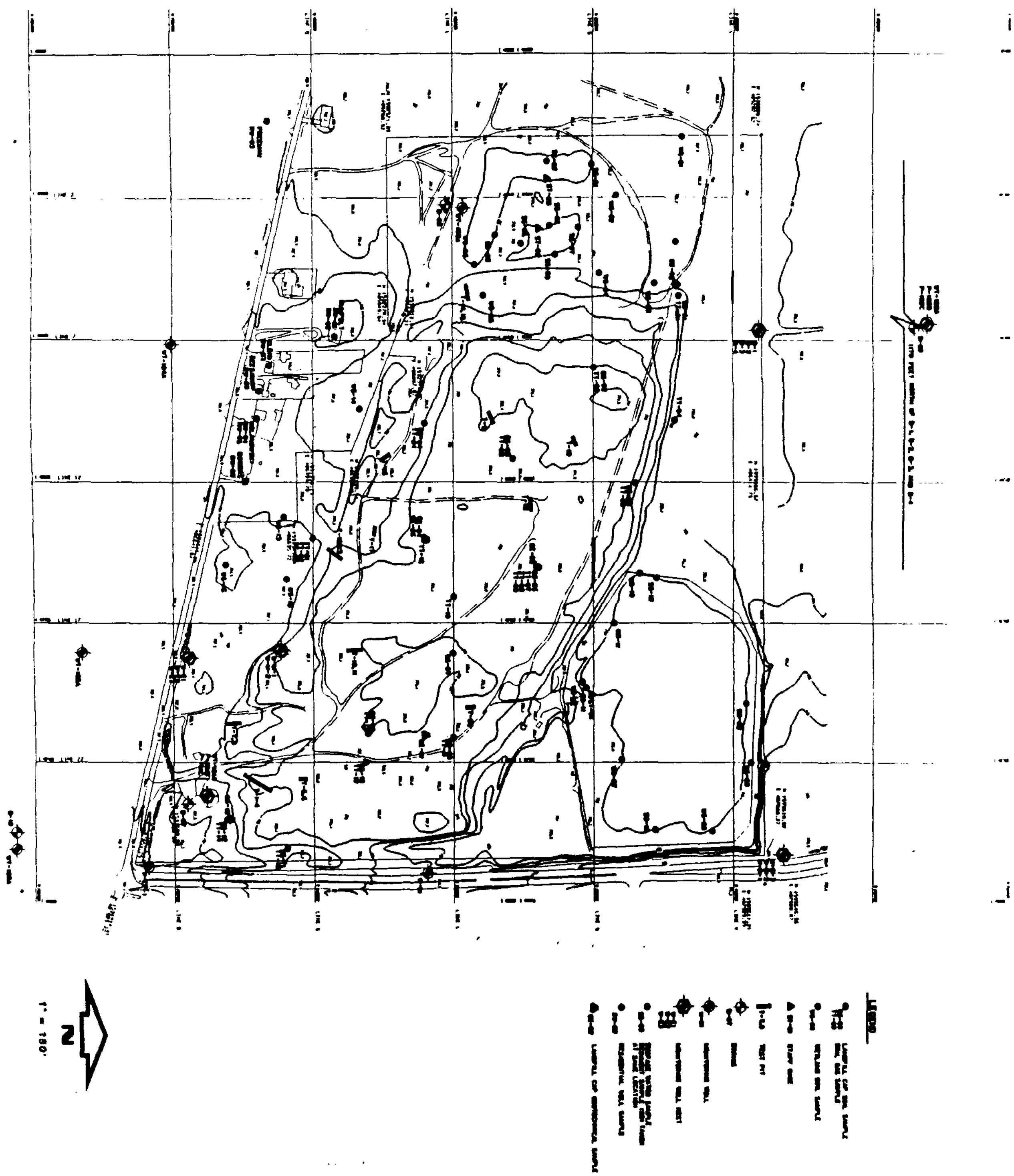
Six shallow soil borings were completed for the installation of water table observation wells. Soil Samples were recovered for chemical analysis from the 0 to 10 foot depth interval or if contamination was indicated or observed, from intervals below 10 feet. Contamination was observed at depths below 10 feet in borings BRG-01, BRG-03, BRG-05, and BRG-06. Soil samples were submitted for VOC, BNA, PCB, pesticides, metals and cyanide analyses. Select soil samples were submitted for geotechnical analyses including TOc, grain size, and Atterberg limits.

Six water table observation wells were installed to intersect the water table. These wells were constructed to provide groundwater elevation information and to facilitate groundwater sampling. Concrete cap and bentonite seal thicknesses were modified to accommodate proper screening due to the shallow water table. Despite these efforts, the water level in WT-103A is above the well screen.

Geotechnical samples of the landfill cap below the surface cover were collected to determine the engineering properties of the cap. Jar and shelby tube samples of the landfill cap were collected and submitted for grain size, Atterberg limit, consolidation undrained triaxial shear, and one-dimensional consolidation testing. Shelby tube samples were potentially pushed into waste material and were appropriately labeled. At one shelby tube sample location no sample was recovered.

FIGURE 1

SAMPLE LOCATION MAP



MAY 1991

FIGURE 1
SITE LOCATION MAP
(TECHNICAL MEMO)

HIMCO DUMP
SUPERFUND SITE
ELKHART, INDIANA

20028

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APPENDIX A

SOIL BORING LOGS

Sheet: 1 of 2

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BORING LOG

SOIL BORING NO. BRG-Ø

SITE: HIMCO Dump PROJECT NO. 20003 003

DRILLING METHOD: CME 550
4 1/4" I.D. HOLLOW-STEM AUGERS (10 LF/ 37)

LOG BY: R. CANNESTRA
DRILLER: D. ELLIS
WEATHER: PTLY CLDY, 45° NW WIND

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING
[illegible]	[illegible]	[illegible]	[illegible]

PHYSICAL SETTING: GRASS ADJACENT TO LANDFILL

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: 11/7/90
DATE COMPLETE:
WELL INSTALLATION: WT-101A

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS (BKGRND HNu 0.2)	B	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O2 / LEL	H2S / CARB
0	EOLIAN	OL-SM	MED DENSE 10YR 2/1 BLACK SILTY SAND, TOPSOIL	22	SS-1	0-2'	13:51	0.2	21.2 / 0	0 / 0
1	OUTWASH	SP	MED. DENSE 10YR 5/6 YELLOWISH BROWN SAND / MEDIUM SUBANG. FROSTED QUARTZ GRAINS, TR F. & C. SAND, TR FM GRAVEL (SUBANG-ANG, POLYMICTIC QUARTZ) NON-PLAS, NON COHESIVE, TR SILT, DAMP	19	3"	0.2 / IN SPOON				
2	OUTWASH	SP	MED. DENSE, 10YR 5/2 YELLOWISH BROWN SAND (F-M, SUBANG-ANG, FROSTED QUARTZ GRAINS) NON PLASTIC, NON COHESIVE, SOME Fe_2O_3 STAINING & MOTTLING IN LOWER 6" OF SPOON, DAMP	16 / 14	SS-2 / 3"	2'-4' / 0.2 / IN SPOON	13:57	0.2	21.1 / 0	0 / 0
4	OUTWASH	SP	MED DENSE MOTTLED 10YR 7/4 & [illegible] VERY PALE BROWN / DARK YELLOWISH BROWN SAND (MEDIUM SUBANG.-SUBANG FROSTED QUARTZ GRAINS) TR [illegible] GRAV (ANG-SUBANG [illegible]) NON PLASTIC, NONCOHESIVE, DAMP. NOTE TIP OF SPOON APPEARS WET	17 / 19	SS-3 / 3"	4'-6' / 0.2 / IN SPOON	14:24	0.2	21.1 / 0	0 / 0
6	OUTWASH	SP	MED. DENSE 10YR 5/4 YELLOWISH BROWN SAND (MEDIUM SUBANG-ANG, FROSTED QUARTZ GRAINS) TRACE C. SAND, TR F GRAVEL (ANG, [illegible]) NON PLASTIC, NON-COHESIVE, MOIST-WET. COLOR CHANGE @ 7.4 TO 10YR 5/3 BROWN, SLIGHT COARSENING @ THIS DEPTH ALSO	13 / 23	SS-4 / 3"	6'-8' / 0.2 / IN SPOON	14:29	0.2 DUPLICATE	21.1 / 0	0 / 3
8	OUTWASH	SP	LOOSE 10YR 5/4 YELLOWISH BROWN SAND (MEDIUM SUBANG [illegible] FROSTED QUARTZ GRAINS) TR C. SAND NON PLASTIC, SLIGHT COHESION, SATURATED	10	SS-5 / 3"	8'-10' / 0.2 / IN SPOON	14:46	0.2	21.2 / 0	0 / 0
10	OUTWASH / BROWN / BLACK	SP	VERY LOOSE 10YR 5/4 YELLOWISH BROWN SAND (MEDIUM-C.S. SUB [illegible] FROSTED QUARTZ GRAINS), NON PLAS, NON COHESIVE, @ 10.7 COLOR CHANGE TO 7.5YR [illegible]. BLACK SAND (MED., SUBANG-SUB RND, FROSTED QUARTZ GRAV., TR GRAVEL [illegible] [illegible] SOLID [illegible] [illegible]) SATURATED, NO ODOR	3 / 12	SS-6 / 3"	10'-12' / 0.2 / IN SPOON	15:00	0.2	21.1 / 0	0 / 0
12	OUTWASH	SP	VERY DENSE 10YR [illegible] DARK GRAY SAND (MEDIUM [illegible] FROSTED QUARTZ [illegible] GRAINS) TR FM GRAVEL (SUBANG [illegible] QUARTZ) NON PLASTIC, NONCOHESIVE, [illegible]	52	SS-7 / 3"	12'-14' / 0.2 / IN SPOON	15:15	0.2	21.1 / 0	0 / 0
14			DENSE 10YR 4/1 [illegible] SILTY SAND (MEDIUM [illegible]							

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BORING LOG

SITE: HIMCO DUMP PROJECT NO. 20026.023

SOIL BORING NO. BRG-01

DRILLING METHOD: CME 550 4¼ IN I.D. HOLLOW STEM AUGERS (8.65' O.D.)
LOG BY: R. CANNESTRA
DRILLER: D. ELLIS
WEATHER:

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING:

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: 11/12/90
DATE COMPLETE: 11/12/90
WELL INSTALLATION: WT-101A

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	SAMPLING DATA: B	N	A	R	SAMPLE TYPE	INTERVAL	AIR MONITORING: TIME	PID	O_2/LEL	H_2S/CAN
		SP	NON PLASTIC, NON COHESIVE, FETID ODOR, SATURATED				17			SEE PREVIOUS PAGE			
			BLIND DRILL BRG-01 TO 17.0' TO ALLOW FOR 'SLUFF' DURING WELL INSTALLATION. NO SAMPLE TAKEN 15.0' TO 17.0'										
17													
			END OF BORING BRG-01 11/12/90 @ 15:40 TOTAL DEPTH 17.0'										
18			Katy Cannestra										
19													
20													

Sheet 1 of ___

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BORING LOG

SITE: HIMCO DUMP PROJECT NO. 20026.

SOIL BORING NO. BRG-2

DRILLING METHOD: C.. (4 1/4 in ID) HOLLOW STEM AUGERS WITH CME 550

LOG BY: R. CANNESTRA

DRILLER: D. ELLIS

WEATHER: CLEAR, LT BREEZE, 46°-48°

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

BACKGROUND PID 0.2

PHYSICAL SETTING:

GROUND SURFACE ELEV.:

COORDINATES:

NORTH:

EAST:

DATE START: 11/10/90

DATE COMPLETE:

WELL INSTALLATION:

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	N	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O2 / LEL	RAD
	EOLIAN	OL-SM	MD 10YR 3/3, DK BROWN SILTY ORGANIC SAND, SAND F-M, ... GRAV (SUBANG ...) ... COHESIVE, NONPLASTIC, MOIST	11	SS-1 3"	0-2 0.2 IN SPOON	13:35	0.2	20.5/0	0
2	OUTWASH	SP-SM	MD, 10YR 3/6, DK YELLOWISH BROWN SILTY SAND, SAND (M-F), TR SM, ..., SUBANG GRAVEL, SLIGHT COHESIVE, NON PLASTIC, MOIST	20						
3		SP	MD, 10YR 4/6, DK YELLOWISH BROWN SAND, F-M, SUBROUNDED FROSTED QUARTZITIC GRAINS, TR (...) ... SUBANG TO SUBRND ... GRAVEL, NON PLASTIC, NON COHESIVE, MOIST - DAMP	13	SS-2 3"	2-4 0.2 IN SPOON	13:45	0.2	20.5/0	0
4				17						
5		SP	D 10YR 6/3 PALE BROWN SAND, F-M, QUARTZITIC ..., SUBANG-SUBRND GRAINS, NON PLAS, NON COHESIVE, MOIST, ...	22	SS-3 3"	4-6 0.2 IN SPOON	14:20	0.2	20.5/0	0
6			MOTTLED W/ ... YELLOWISH BROWN @ 5.5			SPLIT SAMPLE W/ MILES				
7	OUTWASH	SP	MD, 10YR 6/3, PALE BROWN MOTTLED W/ 10YR 5/8, SAND, F-M, QUARTZITIC, FROSTED, SUBRND-SUBANG GRAINS, TR SILT, NON PLASTIC, SLIGHT COHESION, TR ORGANIC FRAGMENTS, MOIST	27	SS-4 3"	6-8 0.2 IN SPOON	14:26	0.2	20.4/0	0
8				18						
9		SP	MD, 10YR 6/4, LT YELLOWISH BROWN SAND F-M SUBRND, FROSTED, QUARTZITIC GRAINS, TR ..., NON PLASTIC, SLIGHT COHESION, TR CO SAND, MOIST - WET	14	SS-5 3"	8-10 0.2 IN SPOON	14:53	0.2	20.5/0	0
10			@ ... COLOR CHANGE TO							
11	OUTWASH	SP	MD 10YR 4/4 DK YELLOWISH BROWN SAND, F-M, TR F & C SAND, GRAINS SUBANG-SUBRND, FROSTED, ..., NON PLASTIC, NON COHESIVE, TR SM GRAV, ..., SATURATED.	20	SS-6 3"	10-12 0.2 IN SPOON	15:05	0.2	20.4/0	0
12				19						
13		SP	DENSE 10YR 5/3 BROWN SAND MEDIUM ... GRAINS ..., QUARTZITIC, SUBANG-SUBRND, 3" LAYER OF ... FINE SAND @ 12.1 ... COHESIVE, NON PLASTIC, SATURATED	20	SS-7 3"	12-14 0.2 IN SPOON	15:35	0.2	.../0	0
14		SP-SM		16						

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BORING LOG

SITE: HIMCO DUMP PROJECT NO. 20026

SOIL BORING NO. B2G-02

DRILLING METHOD: 6 1/4" I.D. (4 1/4 IN I.D.) HOLLOW STEM AUGERS W/ CME 550
LOG BY: R. CANNESTRA
DRILLER: D. ELLIS
WEATHER: CLEAR, LT BREEZE, 40-48°

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: ___

GROUND SURFACE ELEV.: ___
COORDINATES: ___
NORTH: ___
EAST: ___
DATE START: 11/10/90
DATE COMPLETE: ___
WELL INSTALLATION: ___

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	S	N	A	R	SAMPLE TYPE / INTERVAL	TIME	PID	O2/LEL
			10 SUBANG-SUBRND QUARTZITIC FRACTURED GRAVEL SUBANG-SUBRND, DOLOMITIC GRANITE, SATURATED				18	SEE PREVIOUS PAGE			
			END SAMPLING AT 16.0 FT ADVANCE BORING TO 16.8 FT TO ACCOMMODATE SLUFF IN TAKE-UP								

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BORING LOG

SITE: RIMCO Pond PROJECT NO. 20026

SOIL BORING NO. B26-03

DRILLING METHOD: 4 1/4" ID HOLLOW STEM AUGERS (2.65' OD)
LOG BY: R CANNESTRA
DRILLER: D ELLIS
WEATHER: PTLY CLDY,

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING
11/11/90	11:30	4.1	17.0

PHYSICAL SETTING: ADJ TO POND BRUSH FIELD

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: 11/11/90
DATE COMPLETE: 11/11/90
WELL INSTALLATION: WT-103A

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS (BACKGROUND HNU 0.1 PPM)	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2 / LEL	H_2S / CAC
0	EOLIAN	SW-GW	LOOSE 2.5Y 4/2, DK GRAYISH BROWN SAND (M-C) GRAINS QUARTZITIC, SUBANG TO SUBRND, PITTED, 10% SM-L GRAV. (SUBRND, DOLOMITIC.) DAMP		9			SS-1 3"	0-2 0.1 IN SPOON	9:22	0.1	20.6 / 0	0 / 0
1.3	OUTWASH		(3" BROWN SILTY SAND, SOME ORGANICS, TOPSOIL)										
2	OUTWASH	SP	MD, 10YR 5/3 BROWN, SAND (MEDIUM, PITTED, SUBANG-SUBRND QUARTZITIC GRAINS) TO F-CO SAND, TO SM-M GRAVEL (SUBANG-SUBRND DOLOMITIC) NON PLASTIC, NONCOHESIVE, DAMP-MOIST (COLOR CHANGE @ 4.3 @ SPOON TIP)		15		19	SS-2 3"	2-4 0.1 IN SPOON	9:35	0.1	20.6 / 0	0 / 0
3							15						
4	OUTWASH	SP	DENSE, 10YR 5/3 BROWN, SAND (MEDIUM SUBRND, PITTED, FROSTED QUARTZITIC GRAINS) TO F-CO SAND, TO SILT, NONPLASTIC SLIGHT COHESION, SATURATED		45		17	SS-3 3"	4-6 0.1 IN SPOON	9:47 DUPLICATE TAKEN (SOILS)	0.1	20.9 / 0	0 / 0
5													
6	OUTWASH	SP	DENSE, 10YR 5/2, BROWN SAND (MEDIUM SUBRND-RND, PITTED, FROSTED, QUARTZITIC GRAINS) TO F & CO SAND, TO SM GRAV (DK BLACK SUBANG DOLOMITIC CLASTS) NON PLASTIC, NON COHESIVE, SATURATED		43		17	SS-4 3"	6-8 0.1 IN SPOON	9:57	0.1	20.9 / 0	0 / 0
7													
8		SP	DENSE, 10YR 5/3, BROWN, SAND (MEDIUM SUBANG-RND, PITTED, FROSTED, QUARTZITIC GRAINS) TO F & CO SAND NON PLASTIC SLIGHT COHESION, SATURATED.		49			SS-5 3"	8-10 0.1 IN SPOON	10:20	0.1	20.9 / 0	0 / 0
9.3	OUTWASH	SW	AT 9.5, 10YR 5/3 BROWN SAND F-CO LAYER, TO SM GRAVEL, DOLOMITIC SOME FeO STAINING IN THIS LAYER				16						
10		SW	DENSE, 10YR 5/2, GRAYISH BROWN, SAND F-CO, 12-15% GRAVEL (BROWN, BLACK SUBANG, DOLOMITIC CLASTS) NON-PLASTIC, NONCOHESIVE, SATURATED		35		12	SS-6 3"	10-12 0.1 IN SPOON	10:33	0.1	20.9 / 0	0 / 0
11													
12	OUTWASH	SW-GW	DENSE, 10YR 5/1, GRAY, SAND & GRAVEL SAND F-CO, SUBANG-SUBRND FROSTED QUARTZITIC GRAINS, GRAVEL (SM-M SUBANG, DIFFERENT DOLOMITIC CLASTS) TO SILT, NON PLASTIC, NON COHESIVE SATURATED		31			SS-7 3"	12-14 0.1 IN SPOON	10:52	0.1	20.9 / 0	0 / 0

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BORING LOG

SITE: HIMCO DUMP PROJECT NO. 20026

SOIL BORING NO. B2G-03

DRILLING METHOD: 4 1/4" I.D. HOLLOW STEM AUGERS

LOG BY: R CANNESTRA

DRILLER: D. ELLIS

WEATHER: OVERCAST, NW BREEZE

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: ADJACENT TO POND

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: 11/11/90
DATE COMPLETE: 11/11/90
WELL INSTALLATION: WT-103A

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	SAMPLING DATA S	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	AIR MONITORING TIME	PID	O2/LEL
			TR SILT, NONPLASTIC, NON COHESIVE FETID ODOR IN SAMPLE, SATURATED						SEE PREVIOUS PAGE			
			BLIND DRILL TO 17.0' TO ALLOW FOR COLLAPSE DURING WELL INSTALLAT. NO SAMPLE TAKEN 16.0-17									
17			E.O.B. B2G-03 11/11/90 11:15									
			T.D. 17.0 FEET									
			R Cannestra									

Sheet __ of __

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BORING LOG

SOIL BORING NO. BRG-04

SITE: Wimco Dump PROJECT NO. 20036

DRILLING METHOD: CME-550
4 1/4" ID hollow stem augers

LOG BY: Z Canvestra
DRILLER: D Ellis
WEATHER: Overcast

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

BKGRND HNu READING 0.1 PPM
PHYSICAL SETTING: Grass

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: 11/11/90
DATE COMPLETE: 11/11/90
WELL INSTALLATION: WT-104A

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O2 / LEL	RAD / H2S
	EOLIAN	OL-SM	Loose, 2.5Y 3/2 v. dark grayish brown, silty sand, F-M, organics, moist		9		18	SS-1 3"	0'-2' 0.2 ppm in spoon	16:00	0.2	20.9/0	
	OUTWASH	SP	10YR 4/4 sand (medium [illegible] grains) [illegible] moist										
2, 3		SP	Medium dense, 10YR 4/6, dark yellowish brown sand (medium [illegible] F-M, quartzitic grains) [illegible] some silt [illegible] gravel [illegible] slight cohesion, moist		12		14	SS-2 3"	2'-4' 0.2 ppm in spoon	16:07	0.2	20.9/0	0/0
4	OUTWASH	SP	Medium dense mottled 10YR 4/6 (dk yellow brown) & 10YR 7/3 very pale brown sand (F-M subang-subrnd frosted quartzitic grains) tr co sand tr 4mm-M dolomitic gravel (dk brown & tan subang clasts) tr silt, non plastic, slight cohesion, damp		15		17	SS-3 3"	4'-6' 0.2 ppm in spoon	16:26	0.2	20.9/0	0/0
7	OUTWASH	SP	Medium dense 10YR 6/2 pale brown sand, (F-M, subang-ang, frosted quartzitic grains) tr co sand, tr silt tr organic fragments tr co gravel (subang dolo clasts) non-plastic, noncohesive, damp-moist		12		18	SS-4 3"	6'-8' 0.2 ppm in spoon	16:36	0.2	20.9/0	0
8, 9		SP	Loose, 10YR 4/4 dark yellowish brown, sand (F-M, subang-ang frosted quartzitic grains) tr co sand, occ sm dk dolom. gravel (subang-subrnd) nonplastic noncohesive moist (water table appears ~8.3 feet)		5		17	SS-5 3"	8'-10' 0.2 ppm in spoon	16:57	0.2	20.9/0	0/0
10, 11	OUTWASH	SP	Medium dense 10YR 5/3 brown sand (F-M grading finer towards bottom of spoon grains are subang-ang quartzitic) tr co sand, occ sm gravel (dolomitic granitic subang) nonplastic, non-cohesive, saturated		25		12	SS-6 3"	10'-12' 0.2 ppm in spoon	17:08	0.2	20.9/0	0/0
	OUTWASH	SP	Med. dense-dense 10YR 5/3 brown sand (F-M, subang-ang, quartzitic grains) tr co sand, [illegible] nonplastic noncohesive, saturated		20		15	SS-7 3"	12'-14' 0.2 ppm in spoon	17:28	0.2	20.9/0	0/0

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BORING LOG

SOIL BORING NO. BRG-Ø4

SITE: HIMCO DUMP PROJECT NO. 20026

DRILLING METHOD: 4 1/4" ID HOLLOW STEM AUGERS

LOG BY: R. CANNESTRA

DRILLER: D. ELLIS

WEATHER: OVERCAST, NW WIND, 45

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: LEVEL GRASS

GROUND SURFACE ELEV.:

COORDINATES:

NORTH:

EAST:

DATE START: 11/11/90

DATE COMPLETE: 11/11/90

WELL INSTALLATION: WT-104A

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	S	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2 / LEL
		SP	YELLOW BROWN, NON PLASTIC, NONCOHESIVE, SATURATED					SEE PREVIOUS SHEET				
16			NO SAMPLE TAKEN 16.0-17.0 FT. BORING ADVANCED TO 17.6 BY BLIND DRILL TO ACCOMMODATE "SLUFF" IN BOREHOLE FOR WELL INSTALLATION									
			END OF BORING BRG-Ø4 11/11/90 17:45									
			Rolo Cannestra									

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BORING LOG

HIMCO DUMP
SITE: SUPERFUND PROJECT NO. 20026

SOIL BORING NO. BRG-05

DRILLING METHOD: CME 550
4 1/4 IN ID (8 1/4 IN OD)
HOLLOW STEM AUGER
LOG BY: R. CANNESTRA
DRILLER: DAVE ELLIS
WEATHER: OVERCAST

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

PHYSICAL SETTING: ADJACENT TILLED FIELD

GROUND SURFACE ELEV.:
COORDINATES:
NORTH:
EAST:
DATE START: 11-9-90
DATE COMPLETE:
WELL INSTALLATION:

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2 / LEL	GEIGER
					SAMPLING DATA					BACKGROUND PID 0.4 AIR MONITORING			
		OL	MD, 10YR 3/2 V. DARK GRAYISH BROWN SILTY ORGANIC SAND, 3[illegible] SILT, TR-ORGANICS, OCC SM-[illegible] DOLOMITIC GRAVEL, MOIST		13			SS-1 3"	0-2 0.5	15:03 0.5	0.4	20.6/0	0
2	OUTWASH	SP-SM	MD, 10YR 4/6 DK YELLOWISH BROWN SAND, F-M, TR-5% SILT, TR C. SAND, TR SMALL [illegible] [illegible] MOIST				19						
3	OUTWASH	SP	MD, 10YR 4/6 DK YELLOWISH BROWN SAND, F-M, TR SILT, TR C. SAND, TR SMALL [illegible] F-C [illegible] MOIST		12			SS-2 3"	2-4 0.6	15:25 0.6	0.4	20.6/0	0
4							20						
5		SP	MD 10YR 4/6 DK YELLOWISH BROWN SAND, F-M, TR SILT, OCC SM-M [illegible] [illegible] GRAVEL, TR C. SAND MOIST		21			SS-3 3"	4-6 0.7	15:35 0.7	0.5	20.6/0	0
							21						
7		SP	MD 10YR 4/6 DK YELLOWISH BROWN SAND, F-M, TR SILT, TR C. SAND, TR SM [illegible] RND GRAVEL DOLOMITIC, TR DK BLACK GRAVEL @ ZONE OF [illegible] [illegible] ALSO AT APPARENT WT ~7.5'		1[illegible]			SS-4 3"	6-8 1.6	15:45 1.6	0.4	20.9/0	0
8							19						
9		SW-SM	MD 10YR 5/3 BROWN SAND, F-C, TR SILT, TR-5% GRAVEL, DOLOMITIC, SAMPLE PID 2.0 [illegible] ABOVE BKGND, SATURATED		29			SS-5 3"	8-10 2.0	16:00	0.6 / 4.6 BOREHOLE	20.6/0	0
10							15						
11	OUTWASH	SP	MD 10YR 5/3 BROWN, SAND, MEDIUM TO SILT, TR 5% GRAVEL, DOLOMITIC, OCC BLACK GRAINS, [illegible] SMEAR FAMILY [illegible] [illegible] SATURATED		25			SS-6 3"	10-12 3.4	16:25	5.2 / 5.0	20.6/0	0
							15						
	OUTWASH	SP	VD, 10YR 5/3, BROWN, SAND, MED [illegible] TO SILT, [illegible] GRAVEL, DOLOMITE, SUB ANG, OCC [illegible] BLACK GRAINS, SATURATED		57			SS-7 3"	12-14 20.0+	16:4[illegible]	[illegible] / BH 4.4	20/03	0
14													

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Engineers & Architects

COMPUTER AIDED DESIGN/DRAFTING

BORING LOG

SITE: [illegible] PROJECT NO. 20026

SOIL BORING NO. BRG-6

DRILLING METHOD: HOLLOW STEM AUGER

LOG BY: R. [illegible]

DRILLER: J. ELLIS

WEATHER: OVERCAST

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING
11/9	9:40	7.0'	10.0'

PHYSICAL SETTING: GRASS

GROUND SURFACE ELEV.:

COORDINATES:

NORTH:

EAST:

DATE START: 11-08-90

DATE COMPLETE: 11-08-90

WELL INSTALLATION: YES

DEPTH IN FEET	SOIL DEPOSITIONAL ENVIRONMENT	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	B	N	A	R	SAMPLE TYPE	SAMPLE INTERVAL	TIME	PID	O_2 / LEL	GIGGER
		OL	LOOSE 10YR4/2 DARK GRAYISH BROWN SILTY SAND F-M, QUARTZITIC, TR ORGANICS, [illegible]		6			SS-1 3"	0-2' 3.2 ppm	15:25	0.2	20.4 / 0	0
	OUTWASH	SP-SW	LOOSE 10YR 5/6 YELLOWISH-BROWN SAND M-C MOSTLY MEDIUM, TR SM-L SUB RND GRAVEL MOIST		1"								
			DENSE 10YR 5/6 YELLOWISH BROWN SAND M-C, TR SM-M SUBANG TO SUBRND, SOME LIMONITE STAINING MOIST CHANGES COLOR @ 3.3 FT TO 10YR 6/2 LT BROWNISH GRAY SOME MOTTLING		14			SS-2 3"	2-4 0.2 ppm	15:38	0.2	20.9 / 0	0
		SP											
	OUTWASH		DENSE, 10YR 6/6, BROWNISH YELLOW, SAND MEDIUM, TR F&C sand, OCC SM-M SUBRND DOLOMITIC GRAVEL, OCC 1-2 mm LAMINATIONS MOIST		23			SS-3 3"	4-6 0.3 ppm	15:53	0.2	20.9 / 0	0
5													
		SP	DENSE 10YR 5/4 YELLOWISH BROWN, SAND MEDIUM TR F-Co SAND OCCASIONAL RND-SUB RND DOLO GRAVEL SM-M, MOIST WET @ 7.3'		18			SS-4 3"	6-8 0.8 ppm	16:18	0.2	20.9 / 0	0
	OUTWASH	SP	DENSE 10YR 5/3, BROWN, SAND, M-Co Co SAND SEAM 1-2" @ 8.4 FT, TR SILT, OCC SM DOLO GRAVEL (SUB [illegible] - SUBANG) WET & SATURATED		28			SS-5 3"	8-10 0.2 ppm	16:38	0.2	20.9 / 0	0
10	OUT WASH	SP-SW	DENSE 10YR 5/3 BROWN, SAND, F-Co GRAV. SEAM 2" @ 10.9' TR SILT SAND TURNING FINER NEAR TIP GRAV SM-L SUBANG-SUB RND DOLOMITE		44			SS-6 3"	10-12 0.2 ppm	16:54	0.2	20.9 / 0	0
		SP-GP	DENSE-VD 10YR 5/1 M SAND & GRAVEL [illegible] SOLVENT ODOR SATURATED OCC BLACK [illegible]		53			SS-7 3"	12-14 0.2 ppm	17:20	0.2	20.9 / 0	0

APPENDIX B

WELL CONSTRUCTION DIAGRAMS

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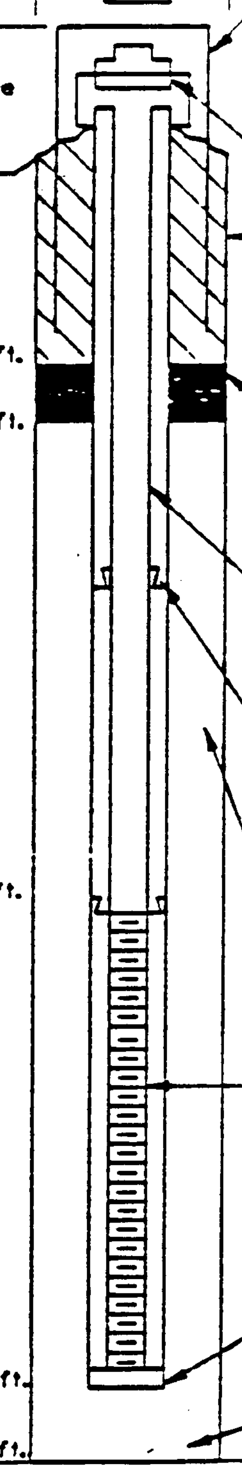
COMPUTER AIDED DESIGN/DRAFTING

Water Table Well Installation Diagram

Form

Site: HIMCO DUMP SITE Date: 11-
Inspected By: R. CANNESTRA Project No. 20026 Well No. WT-102A
R Cannestra Driller/Contractor D. ELLIS / MATHES

Concrete Diameter 0.66'



PVC Stick Up 2.5

2.6 Protective Casing Length

Concrete Thickness 3.0

* Top of Seal 3.0 ft.

Seal Thickness 1.5

* Top 4.5 ft. of Filter Pack

Filter Pack Thickness 12.3

16.0 Well Length

* Top of Screen 5.25 ft.

Screen Length 10.35
ACTUAL OPEN SCREEN 10.0'

* Bottom of Screen 16.0 ft.

Mater. Thickness 0.8

* Boring Depth 16.8 ft.

0.65
Borehole Diameter

* Measured From Ground Surface

PROTECTIVE CASING
Type STEEL Vented (Yes)/No Diameter 4" Length 5.6'

GUARD POSTS
Type LOOSE CAP Locked YES, MASTER Key # 2532

CAP OR PLUG Vented (Yes)/No Type PVC SLIP CAP W/ THREADED PLL

CONCRETE COLLAR
Cement PRE-MIX lbs. + Water ______ gal. ______
Total Quantity 2 BAGS ≅ 7 gal gal.
Manufacturer GENERAL CONTRACTORS ST. LOUIS MISSOURI

SEAL
Powder/Granular (Pellets) 3/8 Quantity 4 g
Hydrated H_2O ≅ 3 gal., Time 17:05-17:35
Manufacturer PELONITE, ROCKTEST, INC

PIPE
Type STAINLESS STEEL Schedule TYPE 5 GRADE 3C
O.D. 2.0 I.D. 1.9
Length/Sec. 10' No. Of Sec. PARTIAL
Manufacturer DIEDRICH

JOINTS Flush Threaded (Yes)/No
Teflon Taped (Yes)/No O-Ring Yes/(NO)
Manufacturer ACE HARDWARE

FILTER PACK Type(s) SILICA SAND #10-20
Source COLORADO SILICA SAND CO
Volume 2 1/2 100 lb BAGS ≅ 22.0 g
Manufacturer COLO SILICA SAND CO, COLORADO SPRINGS, COLO.

SCREEN CONTINUOUS WIRE WRAP
Type STAINLESS STEEL Schedule TYPE 5 GRADE 304
Length/Sec. 5.3 No. of Sec. 2
O.D. ______ I.D. ______
Slot Size 0.010 No. Slots/ft. CONTINUOUS WIRE WRAP
Manufacturers DIEDRICH

CAP OR PLUG Type STAINLESS STEEL Length 0.15

MATERIAL COLLAPSE & FILTER SAND

WATER SOURCE ELKHART MUNICIPAL WATER PLANT

Notes: BORING EXTENDED TO 16.8 RATHER THAN 16.0 TO ALLOW FOR "SLUFF"

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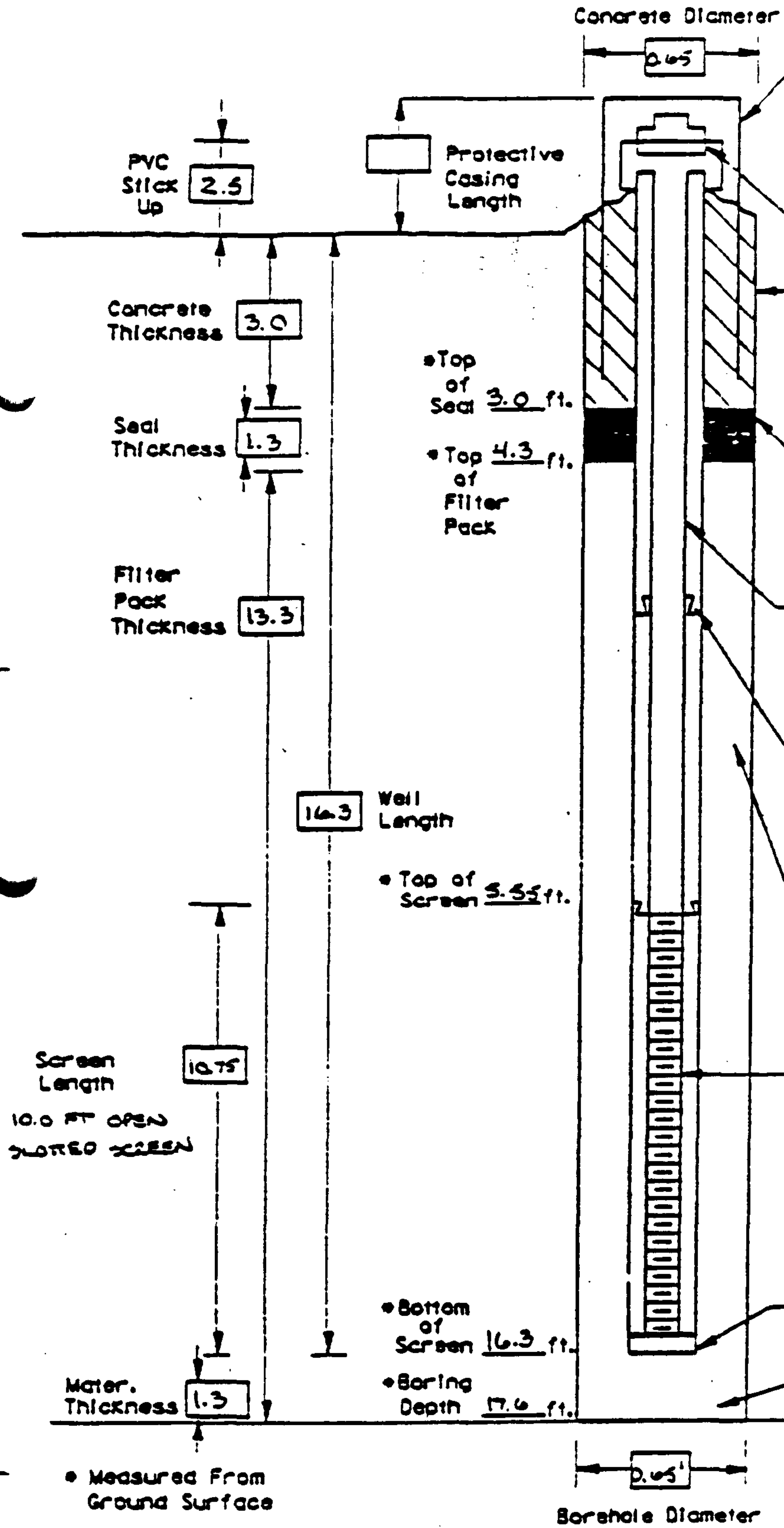
Engineers & Architects
COMPUTER AIDED DESIGN/DRAFTING

Water Table Well Installation Diagram

Form

Site: HIMCO DUMP SITE Date: 11/12/90
Inspected By: R. CANNESTRA Project No. 20021.023 Well No. WT-104A
Driller/Contractor D. ELLIS / MATHES



* Measured From Ground Surface

PROTECTIVE CASING

Type STEEL Vented (Yes)/No
Diameter 4" Locked YES, MASTER
Length 5.6' Key # 2532

GUARD POSTS

Type LOOSE FITTING (2

CAP OR PLUG Vented (Yes)/No Type SLIP CAP (PVC W/ THREADED PLUG

CONCRETE COLLAR

Cement PALMIX lbs.+Water ______ gal. ______
Total Quantity ______ gal. ______
Manufacturer PALMIX

SEAL

Powder/Granular/(3/8" Pellets) Quantity 3.0 c
Hydrated 2.0 gal.. Time 9:50-11:15
Manufacturer PELONITE by ROCTEST

PIPE Type FLUSH THREAD STAINLESS Schedule TYPE 5 ...
O.D. 2.0" I.D. 1.9
Length/Sec. 10.0 No. Of Sec. PARTIAL
Manufacturer DIEDRICH

JOINTS Flush Threaded (Yes)/No
Teflon Taped (Yes)/No O-Ring Yes/(No)
Manufacturer ACE HARDWARE

FILTER PACK Type(s) GRADE 10/20 SILICA SAND
Source COLORADO SILICA SAND
Volume 3.5 100lb BAGS 24.0 c
Manufacturer COLORADO SILICA SAND, INC.
P.O. BOX 15615
COLORADO SPRINGS, CO

SCREEN

Type CONTINUOUS WIRE WRAP - STAINLESS Schedule TYPE 5/304
*Length/Sec. 5.3 No. of Sec. 2
O.D. 2.0" I.D. 1.9
Slot Size 0.010 No. Slots/ft. ______
Manufacturers DIEDRICH

CAP OR PLUG Type STAINLESS THREADED PLUG Length 0.15'

MATERIAL COLLAPSE & FILTER PACK

WATER SOURCE ELKHART MUNICIPAL WATER PLANT

Notes: WATER LEVEL 9.9 FT FROM GS THROUGH AUGERS

* 5.0 FT OPEN SCREEN @ COMPLETION 4.0 12.5 BOTTOM 19.5

Sheet 1 of 1

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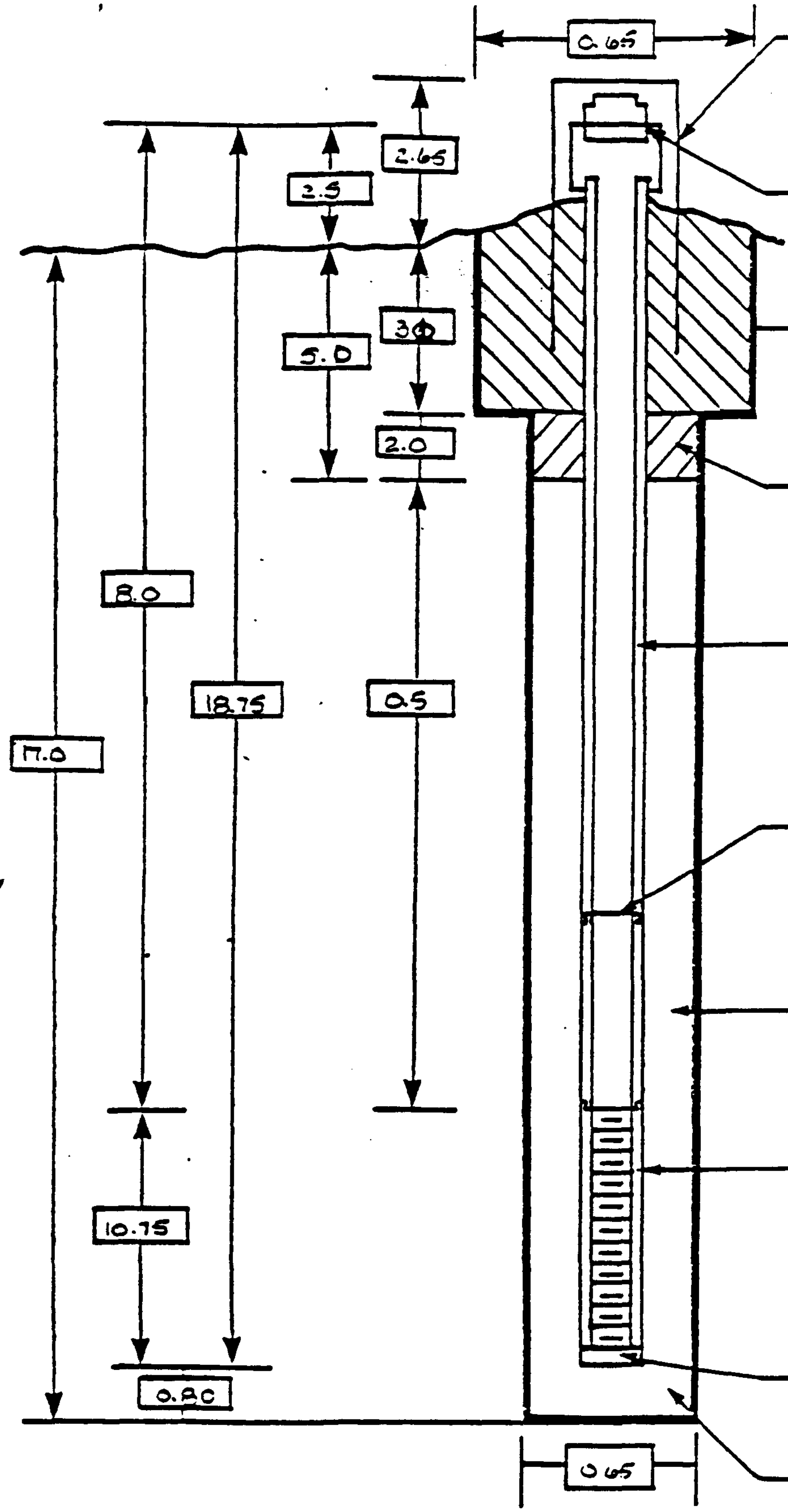
OBSERVATION WELL INSTALLATION DIAGRAM

Well No. WT 106A

Site: HIMCO DUMP, ELKHART, IN Date: NOVEMBER 9, 1990

By: R. CANNESTRA / MATHES Project No. 20026.023



Protective Casing

Type STEEL Vented ✓

Diameter 4" Locked YES MASTER

Length 5.6 Key # 2532

Guard Posts

Type STEEL 3

Plug

Type SLIP COUPLING W/ THREADED PLUG

Vented YES

Concrete Collar PREMIXED

MIXTURE ~~Quant. Cement~~ 160 lbs. + Quant. Water ___ gal.

Total Quant. 5.0 gal.

Manufacturer PREMIX, GENERAL CONTR. ST LOUIS MO

Seal

Powder/Granular/Pellets 3/8 Quant. 5.0 gal.

Manufacturer PELLOITE by BOCTEST

Hydrated 2.5 gal., Time 11:01 – 11:30

Pipe

Type FLUSH THREADED STAINLESS STEEL

O.D. 2.0 " Manufacturer DIEDRICH

I.D. 1.9 " Schedule TYPE S #304

Length/per sec. 10.0 No. of sec. PARTIAL

Joints

Threaded Flush Joint YES

Teflon Taped Yes/No

Tape TEFLON

Manufacturer ACE HARDWARE

Backfill

Type(s) SILICA SAND # 10-20

Source COLORADO SILICA SAND, COLO. SPG.

Volume

Screen

Type CONTINUOUS WIRE WRAP SS Slot Size 0.010

O.D. 2.0 " No. Slots/ft.

I.D. 2.0 " Schedule TYPE S #304

Manufacturer DIEDRICH

Length/per sec. 5.3 No. of sec. 2

Cap

Type THREADED STAINLESS STEEL PLUG (0.15' LENGTH)

Material

COLLAPSE & FILTER PACK

Notes: Water Source ELKHART MUNICIPAL WATER WORKS

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ıgineers & Architects

Atmospheric Monitoring Log
Field Safety

Project Site HIMCO DUMP Health & Safety Officer A. KIRYKOWICZ

Project Number ~~18~~ 20026.023 Level of Protection D

Level of Action

Description of site (weather, temp, soil conditions) PARTLY CLDY, LT NW BREEZE, 33
BACKGROUND HNU READINGS 0.3 ppm

Date / Time	Site	Depth	RAD ~~OVA~~	HNU	OXGEN	LEL / H_2S	Comments
11/12 8:15	WT-104A	17	0.0	0.5	20.6	0 / 0	UNCAPPING AUGERS
11/12 9:10	WT-104A	15	0.0	0.3	20.9	0 / 0	PULL FIRST AUGER FLIGHT
11/12 9:22	WT-104A	10	0.0	0.3	20.9	0 / 0	PULL SECOND AUGER FLIGHT
11/12 9:42	WT-104A	15	0.0	0.3	20.5	0 / 0	PULL THIRD AUGER FLIGHT
11/12 16:20	WT-101A	15	0.0	0.2	21.1	0 / 0	HNU BACKGROUND 0.2 PULL FIRST AUGER FLIGHT
11/12 16:28	WT-101A	10	0.0	0.2	21.1	0 / 0	PULL SECOND AUGER FLIGHT
11/12 16:40	WT-101A	5	0.0	0.2	21.1	0 / 0	PULL THIRD AUGER

Additional Notes: BACKGROUND HNU - 0.3 ppm

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Atmospheric Monitoring Log
Field Safety

Project Site HIMCO DUMP SITE Health & Safety Officer A. KIRYKOWICZ

Project Number 20026 Level of Protection D

Level of Action

Description of site (weather, temp, soil conditions) CLEAR, 35-45, SOILS MOIST-SATURATED HNU BKGRD 0.6 / GASTECH

Date / Time	Site	Depth	~~OVA~~ MIN. RAD	HNU	OXGEN	LEL	Comments
11/10 8:20	WT-105A	16.	0	0.6	20.4	0	READING TAKEN IN BOREHOLE & WORKING AREA, AFTER OPENING HOLE
11/10 8:35	WT-105A		0	0.2	20.4	0	INSTALLING WELL PULL FIRST AUGER
11/10 8:52	WT-105A		0	0.2	20.4	0	" " " SECOND AUGER
11/10 9:08	WT-105A			0.1	20.5	0	THIRD AUGER

Additional Notes:

Signature [illegible] Date 11/10/...

Donohue
Engineers & Architects

Atmospheric Monitoring Log
Field Safety

Project Site HIMCO DUMP Health & Safety Officer A. KIRYKOWICZ

Project Number 20026.023 Level of Protection D

Level of Action

Description of site (weather, temp, soil conditions) PARTLY CLDY, CALM 35°
HN. ~~#1104~~ 719049 BKGRND 1.0 ppm

Date / Time	Site	Depth	RAD ~~OVA~~	HNU	OXGEN	LEL	H2S	Comments
11/13 10:28	T-5	1.5-2.5	0	1.0	21.2	0	0	ONLY ABLE TO PUSH TUBE 1.
11/13 10:40	T-5	1.5-4.5	0	1.0	21.1	0	0	SAMPLE SLIPS OUT OF TUBE
11/13 11:10	O-15	2.0-5.0	0	1.0	21.1	0	0	5" TOPSOIL & ~ 1.0 OF WHITE COVER
11/13 11:30	O-15	2.0-5.0	0	0.2	21.1	0	0	SWITCH HNU BGRND 0.2 TUBE MAY CONTAIN WASTE
11/13 11:55	K-14	1.5-4.5	0	1.0	21.1	0	0	SOIL 0-4", WHITE 4"-± 3.0 BELOW 3' POTENTIAL WASTE
11/13 12:08	K-14 D	1.5-4.5	0	1.0	21.1	0	0	" " "
11/13 14:09	D-24	1.0-4.0	0	1.0	21.2	0	0	SOIL 0-3", CALCIUM SULFATE 3"-1.0' WASTE 1.0 ↓

Additional Notes:

Signature [illegible] Date NOV 13, 19[illegible]

TECHNICAL MEMORANDUM NUMBER 14

DATE: May 1, 1991

TO: Vanessa Harris, Site Manager

CC: Marcia Kuehl, RI Lead
Roman Gau, Project Manager
Mike Crosser, TSQAM

PRELIMINARY

FROM: Anya Kirykowicz
Dave Richardson

SUBJECT: EPA ARCS Region V Contract No. 68-W8-0093
EPA Work Assignment No. 17-5L4J
Himco Dump RI/FS
Donohue Project No. 20026.024

WETLANDS ASSESSMENT AND IDENTIFICATION

Introduction

On October 22, 23, and 24, 1990 Donohue & Associates, Inc. conducted an on-site wetlands assessment and identification at the Himco Dump Superfund Site as part of the RI Work Plan. The delineation was conducted by Dave Richardson and Anya Kirykowicz. Three suspected wetland areas were designated as Northwest Wetland Area, Wetland Remnant, and Gravel Pit Wetland Area. The location of these areas is presented in Figure 1.

Methods

As outlined in Section 4.6.1 of the Final Field Sampling Plan, Himco Dump RI/FS Elkhart, Indiana, three essential characteristics were used to identify wetland areas. These characteristics are: hydric soils, wetland hydrology, and hydrophytic vegetation. These characteristics and their technical criteria are described below. The approximate boundaries between wetland and upland areas were identified using methods prescribed in the "Federal Manual for Identifying and Delineating Jurisdictional Wetlands" (Federal Interagency Committee for Wetland Delineation, 1989). The Disturbed Area Wetland Determination Method was used, with the hydrophytic vegetation assessment taking the lead. Sampling tube cores were used to examine the soil profile for hydric soils and wetland hydrology. An assessment of hydrophytic vegetation was made at each sampling tube core. The following equipment was used: soil sampling tube, dead blow hammer, site map, field notebook, Munsell Soil Color Charts, flagging tape, wooden lathe, camera, plastic bags, field guides for plant identification, USGS topographic map, Hydric Soils of the United States List, and an aerial photograph.

Wetland Hydrology

Wetland hydrology is defined as permanent or periodic inundation or prolonged soil saturation sufficient to create anaerobic conditions in the soil. The wetland hydrology criterion is met if a site is inundated or saturated to within 1.5 feet below the surface, based on the soil drainage characteristics, for at least one consecutive week during the growing season in an average rainfall year (Federal Interagency Committee for Wetland Delineation, 1989). This criterion is the least exact and the most difficult to assess in the field.

Hydric Soil

Hydric soils are defined as soils that are saturated, flooded or ponded long enough during the growing season to develop anaerobic conditions in the upper part (U.S.D.A. Soil Conservation Service, 1987). An area has hydric soils when the National Technical Committee for Hydric Soils criteria are met. These criteria relate to soil types, soil drainage characteristics, water table levels and frequency of flooding or ponding.

Hydrophytic Vegetation

Hydrophytic, or wetland, vegetation is defined as macrophytic plant life growing in water, soil or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content (Federal Interagency Committee for Wetland Delineation, 1989). The U.S. Fish and Wildlife Service publishes a list of plant species that occur in wetlands by region. Each species in the list is given an indicator status reflecting the range of estimated probability that it may occur in a wetland versus non-wetland area across its entire distribution. These indicator categories are listed below:

- Obligate Wetland (OBL). Occur almost always (estimated probability >99%) under natural conditions in wetlands.
- Facultative Wetland (FACW). Usually occur in wetlands (estimated probability 67%-99%), but occasionally found in non-wetlands.
- Facultative (FAC). Equally likely to occur in wetlands or non-wetlands (estimated probability 34%-66%).
- Facultative Upland (FACU). Usually occur in non-wetlands (estimated probability 67%-99%), but occasionally found in wetlands (estimated probability (1%-33%).
- Obligate Upland (UPL). Occur in wetlands in another region, but occur almost always (estimated probability >99%) under natural conditions in non-wetlands in the region specified. If a species does not occur in wetlands in any region, it is not on the National List.

The hydrophytic vegetation criterion for wetland identification is met when more than 50 percent of the dominant species at a given site are obligate, facultative wetland or facultative species.

Deviations

The three suspected wetland areas were renamed in the field. The Northwest Wetland Area was divided into Area I and Area II. The Gravel Pit Wetland was designated Area III. The Wetland Remnant was designated Area V. An area immediately south of the gravel pit was designated Area IV. This area was added to the field investigation based on visual observations. The study areas are shown on Figure 1.

Summary of Results

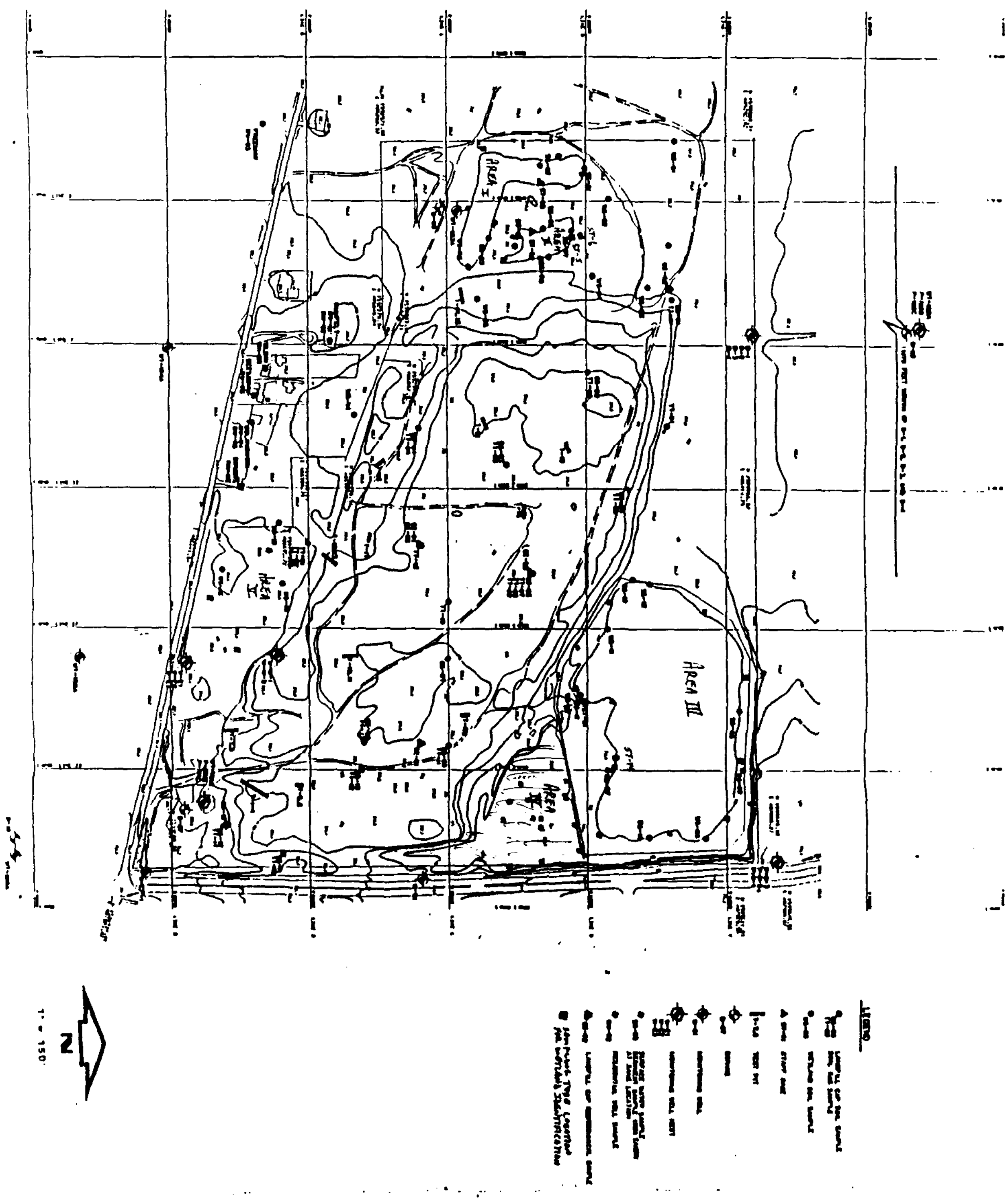
Sampling tube cores were used to examine the soil profile for hydric soils and wetland hydrology. A total of thirty-nine sites were chosen for soil sampling, representing the various conditions on the site. The vegetation was sampled at these 39 sites. Some of the plant species were not identified in the field but were collected , tagged, and identified off-site. Field work was conducted in late autumn, making identification difficult. The locations for the 39 sites are shown on Figure 1.

The only area identified as a wetland was Area IV. All of the other locations were non-wetland based on existing normal conditions or due to fill materials that were placed in close proximity to open water.

Hydrophytic vegetation identified in these wetland areas included: Typha angustifolia (Narrow-leaf Cattail-OBL), Carex sp. (Sedge sp.), Equisetum hyemale (Rough Horesetail-FACW), Solidago gigantea (Giant Goldenrod-FACW), Salix sp. (Willow sp.), Aster novae-angliae (New England Aster-FACW), and other Solidago sp. and Aster sp.

AK:llw

A/R/HIMCO/AB9



MAY 1991

FIGURE 1
SITE LOCATION MAP
(TECHNICAL MEMO)

HIMCO DUMP
SUPERFUND SITE
ELKHART, INDIANA

20026

Donohue ENGINEERS ARCHITECTS SCIENTISTS

TECHNICAL MEMORANDUM NUMBER 15

DATE: January 25, 1991

TO: Vanessa Harris - Site Manager

PRELIMINARY

CC: Marcia Kuehl - RI Lead
Roman Gau - Project Manager
Mike Crosser - TSQAM

FROM: Tom Puchalski
Anya Kirykowicz

SUBJECT: EPA ARCS Region V Contract No. 68-W8-0093
EPA Work Assignment No. 17-5L4J
Donohue Project No. 20026.024
Himco Dump RI/FS

WETLAND SOIL SAMPLING

Introduction

Sixteen soil samples were collected from three suspected wetland areas at the Himco Dump Site on October 21, 22, and 23, 1990; six from the Northwest Wetland Area, four from the Wetland Remnant, and six from the Gravel Pit Wetland Area (Figure 1). These soil samples were collected to investigate for possible soil contamination associated within these possible wetland areas. Sampling locations were selected to include what were suspected to be areas of most likely contamination. These areas included suspected wetland areas receiving drainage from the landfill cover as determined by aerial photography and field observations, and areas of apparent stressed vegetation. Soil samples were composited at each location from 0 to 18 inches or shallower where the auger met with refusal. Wetland soil sampling for chemical analysis was performed by Eric Slusser and Tom Puchalski of Donohue & Associates, Inc.

Methods

Section 4.6.4 of the Final Field Sampling Plan, Himco Dump RI/FS, Elkhart, Indiana, describes the wetlands soil sampling procedures. A hand auger was used to collect the sample at each location. After gathering soil to the required 18-inch depth, grab samples were retrieved from the sample bowl and put in 4-oz. glass jars for volatile analysis. These jars were filled with no head space remaining. The remaining soil was classified (USCS), the color identified using a Munsell Color Chart, and examined for obvious signs of contamination. This information was recorded on a soils data form (Appendix A). A stainless steel spoon was used to stir the remaining soil until a homogeneous mixture was obtained.

The hand auger, mixing spoon, and composite bowl were decontaminated between sampling points using an alconox and tap water wash, a tap water rinse, an isopropanol rinse, and two deionized or distilled water rinses. Isopropanol rinses were captured in a 5-gallon bucket and covered for eventual discharge into the on-site frac tank. A photograph was taken of each wetland soil sampling location.

Deviations

The sixteen sampling locations were selected prior to the wetland assessment and identification. Only one of the locations designated as a wetland sample (WS-#) was from a wetland location. WS-07 was located near ST-14 (sampling tube-14) of the wetland identification procedures. ST-14 met all three of the wetland criteria - hydric soil, hydrology and hydrophytic vegetation.

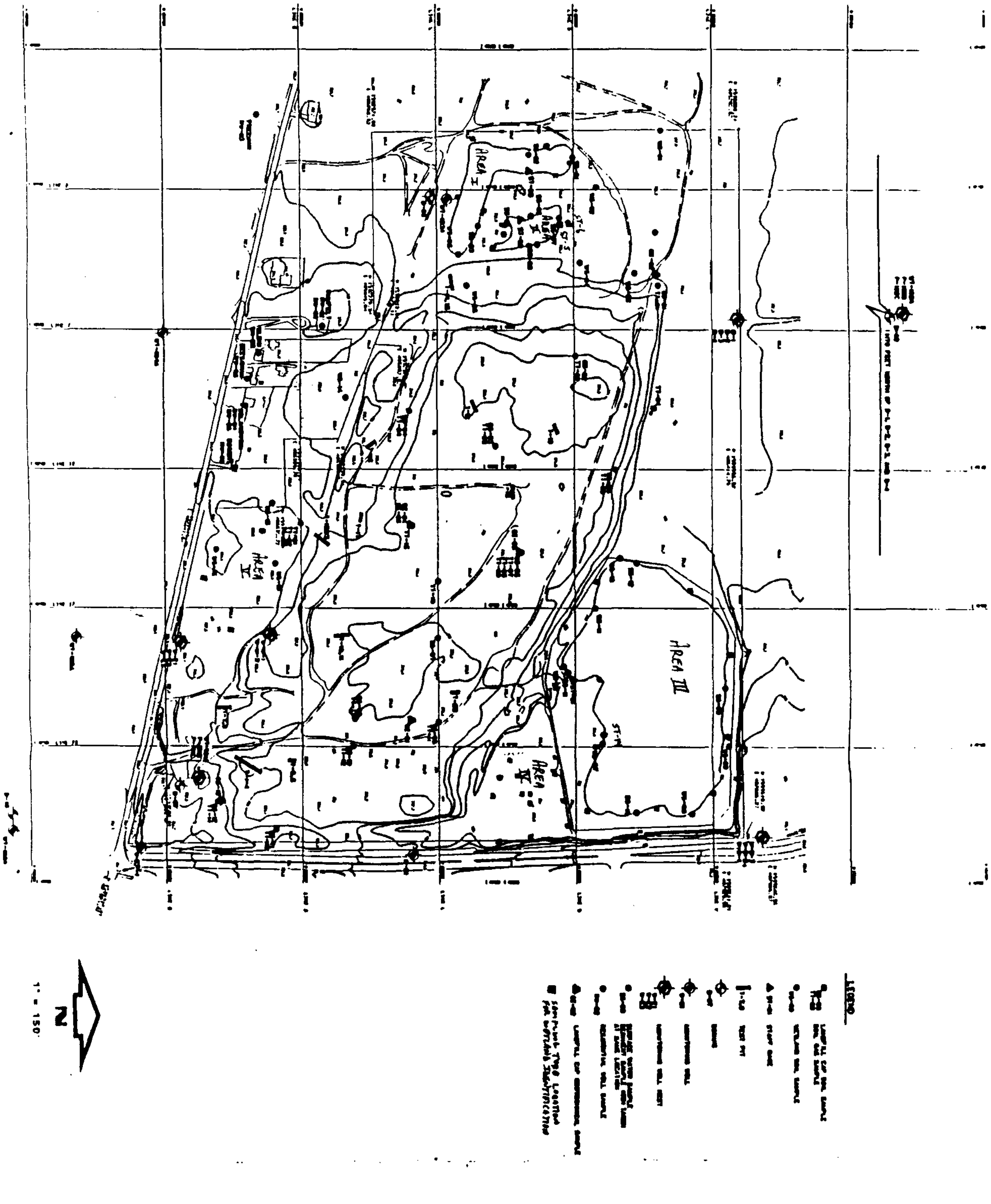
A stainless steel hand auger was used to collect the soil sample rather than a sampling tube as was described in the sampling plan. Besides being more labor intensive, a sampling tube does not collect sufficient soil volume to fill the required sample jars. Several pushes of the tubes would have been required at each sampling location. With the hand auger, sufficient sample volume was collected with one run from 0 to 18 inches.

Summary of Results

Sixteen soil samples for chemical analysis were collected in suspected wetland areas. Sample locations are provided in Figure 1. Wetland Soil Data forms are provided in Appendix A. A summary of wetland soil sampling locations, suspected wetland area, and materials encountered is provided in Appendix B.

TP:AK:llw

A/R/HIMCO/AB3



MAY 1991

FIGURE 1
SITE LOCATION MAP
(TECHNICAL MEMO)

HIMCO DUMP
SUPERFUND SITE
ELKHART, INDIANA

20028

Donohue ENGINEERS ARCHITECTS SCIENTISTS

APPENDIX A

[redacted]

SHEET 1 OF 1

Soil Sample Area Northwest area

Soil Subsample WS-1

Engineers & Architects & Scientists   Site Hiram Dunn   Project No. 20026.023

DATE 10/21/90

TIME 1625

COLLECTOR TOM DUCHALSKI
ERIC SLUSSER

SAMPLE DEPTH 0-18"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: North end of Norwest wetland remnant in grassy area.

DESCRIPTION OF SUBSAMPLE: 10YR 4/1 Dark grey silty sand (SM), low coh., moist

ANY OTHER CHARACTERISTICS OF NOTE: 1" of moss at surface, mits to 3"

SHEET 1 OF 1

Donohue | Soils Data Form | Soil Sample Area Northwest Pe
Soil Subsample NS-2

Engineers & Architects & Scientists | Site Himco Dump | Project No. 20026.023

DATE 10/21/90

TIME 1645

COLLECTOR TOM PUCHALSKI
ERIC SLUSSER

SAMPLE DEPTH 0-18"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: South end of Northwest Remnant in prairie.

DESCRIPTION OF SUBSAMPLE: 10YR 6/1 Light gray silty sand (SM) low coh, moist

ANY OTHER CHARACTERISTICS OF NOTE:

SHEET 1 OF 1

Donohue | Soils Data Form | Soil Sample Area Northwest [illegible]
Soil Subsample NS-03

Engineers & Architects & Scientists | Site [illegible] | Project No. 20026.03

DATE 10/22/90

TIME 857

COLLECTOR ERIC SLUSSER
DOROTHEA DOWNS
TOM PUCHALSKI

SAMPLE DEPTH 0-6"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: Low area 40 yards south of tree line & 50 yards west of landfill fill & capped area.

DESCRIPTION OF SUBSAMPLE: 10 YR 3/1 Very dark gray, silty sand (SM) fine grained 60% sand 40% silt, moist, low coh, roots

ANY OTHER CHARACTERISTICS OF NOTE: Refusal at gravel layer 6" below surface

Donohue	Soils Data Form	Soil Sample Area [illegible]
		Soil Subsample WS-04
Engineers & Architects & Scientists	Site Hinge Dump	Project No. 20226.023

DATE 10/22/92

TIME 9:40

COLLECTOR Eric Slusser
Dorothea Down

SAMPLE DEPTH 0-18"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: ~~Flat~~ low area
30 ~~yds~~ yards ~~south~~ ~~west~~ east of tree line and 60 yards west of landfill fill
and capped area.

DESCRIPTION OF SUBSAMPLE: 7.5 YR 5/4 Brown silty sand 0-12"
(SM) fine grained 65% sand 35% silt moist, low coh roots upper
6" 12-15" gray 7.5 YR 5/0 Gray silty sand (SM) fine grained
65% sand, 35% silt low coh, moist - sat H_2S smell

ANY OTHER CHARACTERISTICS OF NOTE: H_2S smell in gray silty
sand

SHEET 1 OF 1

Donohue | Soils Data Form | Soil Sample Area [illegible]
Soil Subsample [illegible]

Engineers & Architects & Scientists | Site Hinc[illegible] D[illegible] | Project No. 2002[illegible]023

DATE 10/22/92

TIME 10:16

COLLECTOR Eric S[illegible]
D[illegible] D[illegible]

SAMPLE DEPTH 0-18"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: flat low area in 40 yard east of pond 50 yards west of landfill filled and scraped area. ~~[illegible]~~ horsetails cattails present

DESCRIPTION OF SUBSAMPLE: 0-12" 7.5 YR 5/4 Brown silty sand (SM) fine grain 65% sand 35% silt moist low coh roots upper 2-3"
12-18 10 YR 3/0 V. Dark Gray silty sand (SM) 65% sand 35% silt wet low coh

ANY OTHER CHARACTERISTICS OF NOTE: H_2S smell from V Dark Gray silty sand ~~[illegible]~~ refusal ~~[illegible]~~ 20"

Donohue — Soils Data Form

Soil Sample Area [illegible]
Soil Subsample WS-06

Engineers & Architects & Scientists — Site Humco Dump — Project No. 20026.023

DATE 10/23/90
TIME 0825
COLLECTOR TOM PUCHALSKI
ERIC SLUSSER

SAMPLE DEPTH 0-12"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: East shore of L shaped pond at southeast end of pond at midpoint, 6" from water edge.

DESCRIPTION OF SUBSAMPLE: 10 YR 5/4 yellowish Brown, fine grained silty sand (SM).

ANY OTHER CHARACTERISTICS OF NOTE:

Donohue — Soils Data Form

Engineers & Architects & Scientists

Soil Sample Area: Quarry

Soil Subsample: WS-07-1

Site: Himco Dump

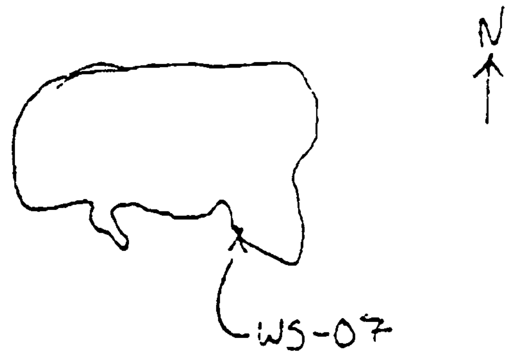
Project No.: 20026-02

DATE: 10/21/90

TIME: 955 AM

COLLECTOR: TOM PUCHALSKI
ERIC SLUSSER

SAMPLE DEPTH: 0-14"



PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: Southeast corner of quarry pond in 4" of clear water in cattails

DESCRIPTION OF SUBSAMPLE: 5Y 3/1 Very dark gray fine grained silty sand (SM), ang graded, trace small shells.

ANY OTHER CHARACTERISTICS OF NOTE: Slight H_2S odor

Donohue	Soils Data Form	Soil Sample Area Quarry
		Soil Subsample US-081
Engineers & Architects & Scientists	Site Himes Dump	Project No. 20026.023

DATE 10/21/90

TIME 1051 AM

COLLECTOR TOM DUCHALSKI
ERIC SLUSSER

SAMPLE DEPTH 0-18"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: Northeast corner of quarry pond in 8" of clear water in cattail area

DESCRIPTION OF SUBSAMPLE: 5Y 3/1 very dark grey fine grained silty sand (SM), angular grains, trace of small shells

ANY OTHER CHARACTERISTICS OF NOTE: H_2S odor

Donohue
Engineers & Architects & Scientists

Soils Data Form

Soil Sample Area Quarry
Soil Subsample WS-04

Site Hinca Dump Project No. 20026.02

DATE 10/21/90

TIME 1122 AM

COLLECTOR TOM RUCHALSKI
ERIC SLUSSER

SAMPLE DEPTH 0-18"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: On north shore of quarry 5 foot north of water edge in horse tails 0-4" gravel ≈ ¼-½" & sand grading to gravelly sand 4"-18".

DESCRIPTION OF SUBSAMPLE: 10 YR 5/3 Brown ~~sandy~~ CEP 10/21/90 gravelly sand (SW) 20% ½" above gvl sand-angular fn to med gravel

ANY OTHER CHARACTERISTICS OF NOTE:

SHEET 1 OF 1

Donohue — Soils Data Form

Soil Sample Area [illegible]

Soil Subsample WS-10

Engineers & Architects & Scientists

Site Hi[illegible] Dump

Project No. 20026.09[illegible]

DATE 10/21/00

TIME 1412 PM

COLLECTOR TOM PUCHALSKI
ERIC SLISSER

SAMPLE DEPTH 0-18"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: Middle of west bank in 8" water. Edge of cattails. 1 foot off shore

DESCRIPTION OF SUBSAMPLE: ~~5~~ 10YR 5/3 Brown fine grained sand (SP)

ANY OTHER CHARACTERISTICS OF NOTE:

SHEET 1 OF 1

Donohue

Soils Data Form

Soil Sample Area Quarry

Soil Subsample 10S - 11's Dup

Engineers & Architects & Scientists

Site Wimin Dump

Project No. 20026.02

DATE 10/21/90

TIME 1438

COLLECTOR TOM DUCHALSKI
ERIC SLUSSER

SAMPLE DEPTH 0-18"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: South shore of quarry, 70 yards east of west shore 1' off shore

DESCRIPTION OF SUBSAMPLE: 10YR 5/3 Brown mixed with 5Y 3/1 very dark grey, finegrained sand-silty (SM) with trace 1/2" sized gvl

ANY OTHER CHARACTERISTICS OF NOTE: H_2S odor in grey areas. Roots intertwining to form a cluster at surface to 3"

SHEET 1 OF 1

Donohue

Soils Data Form

Soil Sample Area Quarry

Soil Subsample WS-12

Engineers & Architects & Scientists

Site Hinkle Dump

Project No. 8CC26C23

DATE 10/21/90

TIME 1550

COLLECTOR TOM PUCHALSKI
ERIC SLIKKER

SAMPLE DEPTH 0-18"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: South shore of quarry towards south edge of bay at base of steep bank in 6' of water.

DESCRIPTION OF SUBSAMPLE: Multi-colored gravel ≈½" sbang. 10% fine sand

ANY OTHER CHARACTERISTICS OF NOTE:

SHEET 1 OF 1

Donohue Soils Data Form Soil Sample Area [illegible]

Soil Subsample LS-13

Engineers & Architects & Scientists Site Himco Dump Project No. 20026.02

DATE 10/23/90

TIME 1355

COLLECTOR TOM PUCHALSKI
ERIC SLUSSER

SAMPLE DEPTH 0-18"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: Southwest corner of wetland remnant near Klein property, 100' north in grassy area

DESCRIPTION OF SUBSAMPLE: 10 YR 3/2 Very Dark Greyish Brown Silty Sand (SM) 30% silt 70% fine grained angular sand, roots to 3" loose, moist, grass at surface

ANY OTHER CHARACTERISTICS OF NOTE:

SHEET 1 OF 1

Donohue Soils Data Form

Soil Sample Area S. Wetland

Soil Subsample WS-1N

Engineers & Architects & Scientists

Site Hinco Dump Project No. 20026.023

DATE 10/23/90

TIME 1418

COLLECTOR TOM PUCHALSKI
ERIC SUSSER

SAMPLE DEPTH 0-8" - Refusal at gravel layer

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: West edge of south wetland remnant 15 yards south of old rail road grade in low grassy area.

DESCRIPTION OF SUBSAMPLE: 10YR 4/4 Dark Ylwish Brown silty sand (SM) 70% fine grained/granular sand, 30% silt, low coh., moist

ANY OTHER CHARACTERISTICS OF NOTE:

SHEET 1 OF 1

Donohue — Soils Data Form — Soil Sample Area [illegible]
Soil Subsample WS-15 [illegible]

Engineers & Architects & Scientists — Site Hinze Dump — Project No. 20026.03

DATE 10/22/96
TIME 1431
COLLECTOR TOM PUCHALSKI
ERIC SLUSSER

SAMPLE DEPTH 0-6" – Refusal at gravel layer 2" strong

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: 40 yards south of old railroad grade in open grassy area near east edge of remnant – 100 yards ~~[illegible]~~ west of east border

DESCRIPTION OF SUBSAMPLE: 10YR 3/2 Very Dark Grayish Brown silty sand (SM) 70% fn grn ang snd, 30% silt, low coh, moist

ANY OTHER CHARACTERISTICS OF NOTE: Methane odor in air

SHEET 1 OF 1

Donohue | Soils Data Form | Soil Sample Area [illegible]
Soil Subsample 11K-1C

Engineers & Architects & Scientists | Site Himco Dump | Project No 20026.023

DATE 10/23/90

TIME ~~2~~ 1455

COLLECTOR TOM PUCHASKI
ERIC SLUSSER

SAMPLE DEPTH 0-8"

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: 40 yards north of road in brushy, grassy area of southeast portion of southeast wetland remnant.

DESCRIPTION OF SUBSAMPLE: 10 YR 3/1 very dark grayish brown silty sand (SM) 70% fine grain ang sand, 30% silt, loose, dry, [illegible], roots to 2".

ANY OTHER CHARACTERISTICS OF NOTE:

APPENDIX B

APPENDIX B

WETLAND SOIL SAMPLE NUMBER	SUSPECTED WETLAND AREA LOCATION	SAMPLE CHARACTERISTICS
01	*	Dark grey silty sand. Moss at surface, roots to 3".
02	*	Light grey silty sand
03	*	Very dark grey silty sand. Refusal at gravel layer (6" below surface).
04	*	Grey silty sand; H_2S odor.
05	*	Dark grey silty sand; H_2S odor (refusal at 20").
06	I	Yellowish brown silty sand.
07	III	Very dark grey silty sand. Trace small shells; H_2S odor.
08	III	Very dark grey silty sand. Trace small shells; H_2S odor.
09	III	Brown gravelly sand.
10	III	brown fine grained sand.
11	III	Brown mixed with very dark grey silty sand H_2S odor in grey areas.
12	III	Multi-colored gravel and fine sand.
13	V	Very dark greyish brown silty sand.
14	*	Dark yellowish brown silty sand.
15	V	Very dark greyish brown silty sand.
16	V	Very dark greyish brown silty sand.

* Located outside of suspected wetland area

A/R/HIMCO/AB3

TECHNICAL MEMORANDUM NUMBER 16

DATE: May 1, 1991

TO: Vanessa Harris, Site Manager

CC: Marcia Kuehl - RI Lead
Roman Gau - Project Manager
Mike Crosser - TSQAM

FROM: Anya Kirykowicz

SUBJECT: EPA ARCS Region V Contract No. 68-W8-0093
EPA Work Assignment No. 17-5L4J
Donohue Project No. 20026.024
Himco Dump RI/FS

WATER LEVEL MEASUREMENTS

Introduction

Water level and well depth measurements were taken at the Himco Dump Site on November 6, 1990, February 1, 1991 and February 2, 1991. Static water levels were measured and recorded to determine groundwater flow directions and gradients at the site (water table elevations map). Water level and well depth measurements were also taken after installation of new wells, before and after well development and during scheduled groundwater sampling. Information concerning those measurements may be found in the respective technical memorandums. Water level and well depth measurements were conducted by Rob Cannestra, Anya Kirykowicz and Tracey Koach of Donohue & Associates, Inc. Well locations are shown in Figure 1.

Methods

Section 4.2.3.3 and Section 4.2.3.4 of the Final Field Sampling Plan, Himco Dump RI/FS, Elkhart, Indiana, described water level, well depth measurements and decontamination procedures. The water level surface was measured using poppers and electronic water level indicators. Each well had a reference point on top of the PVC well casing, from which water level measurements were taken. Measurements were noted to the nearest 0.01 feet. Each well was surveyed with respect to mean sea level elevation with an accuracy of 0.01 feet. Water level, well depth and staff gauge measurements were made within a 24-hour period.

The poppers and electric water level indicators were decontaminated between wells using an Alconox soap and tap water wash, tap water rinse, isopropanol rinse and two deionized or distilled water rinses. The isopropanol rinses were captured in a 5-gallon bucket and covered for discharge into the on-site frac tank.

Deviations

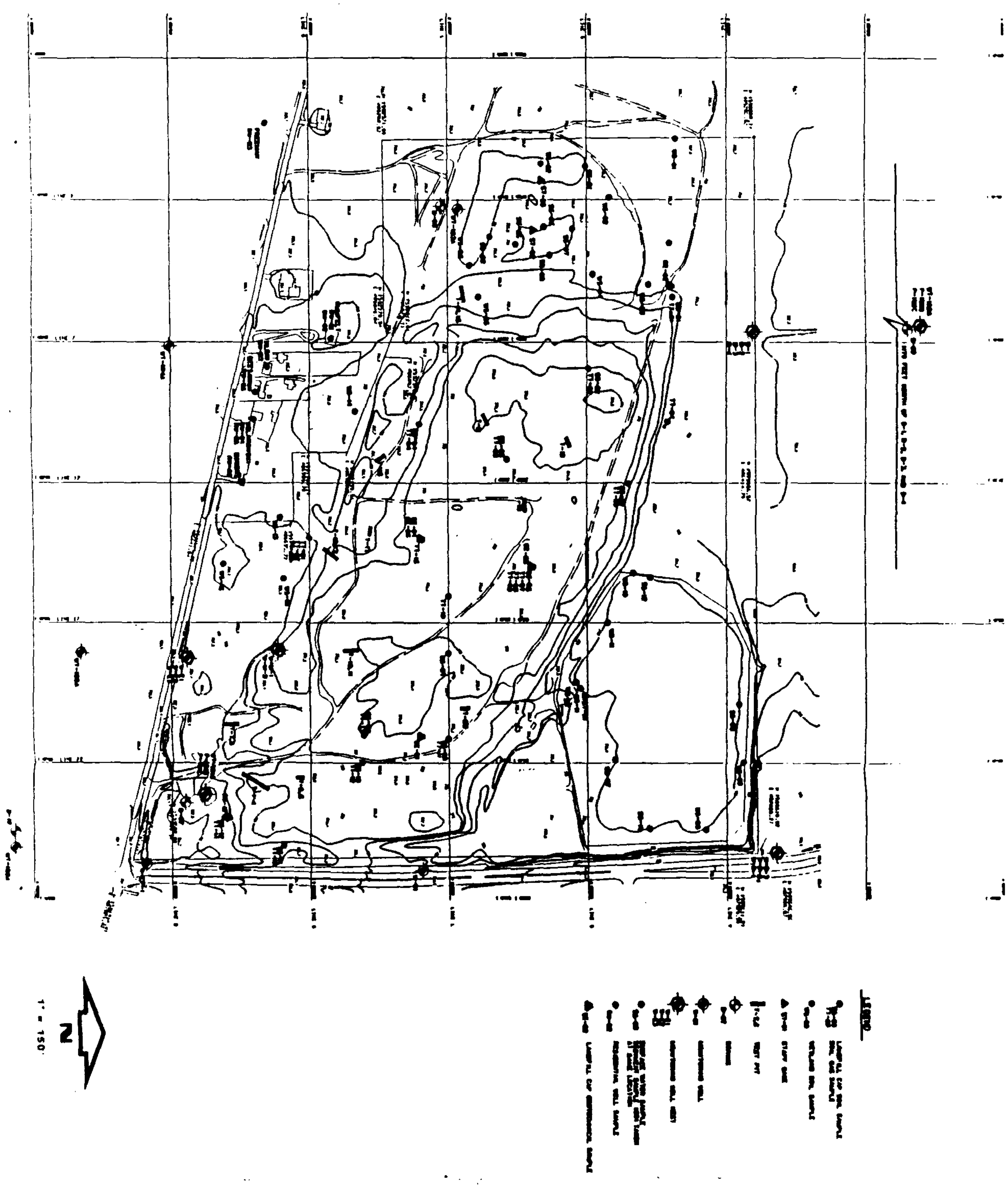
Distilled water rinses were used during decontamination procedures in addition to deionized water.

Summary of Results

Water level measurement forms are attached.

AK:lh

A/R/HIMCO/ACO



MAY 1991

FIGURE 1
SITE LOCATION MAP
(TECHNICAL MEMO)

HIMCO DUMP
SUPERFUND SITE
ELKHART, INDIANA

20025

Donohue ENGINEERS ARCHITECTS SCIENTISTS

DONOHUE

WATER ELEVATION

PROJECT NO. 20026 SITE HIMCO DUMP - INITIAL WELL INVENTORY

WELL NUMBER	ELEVATION OF TOP OF PIPE	DEPTH TO WATER	WATER ELEVATION	DEPTH TO BOTTOM	WELL INTEGRITY				COMMENTS Popper assumed prior to 1st water level and initial wells
					[illegible]	[illegible]	[illegible]	[illegible]	
E-1?	771.11	12.15'		81.38'	X	X			11/6/90 (Northeast Nearb)
E-2		11.62'		19.49		X			11/6/90 (Middle) NO PROTECTIVE CASING
E-3		12.99'		175.58	X	X			11/6/90 5" ID (Farthest south)
N-1		9.96'		29.25'		X			11/6/90 NOT locked
B-4		9.55'		175.12'	X	X			11/6/90 NO protective casing (Farthest East) 5" ID
B-3		8.34'		130.23	X	X			11/6/90 NO protective casing 5" ID
B-2		7.04'		13.91'		X			11/6/90 NO protective casing 2" ID
B-1		7.38'			X	X			11/6/90 NO protective casing (Farthest West) 5" ID
CP-1	UNABLE TO OPEN					X			11/6/90 NO protective casing LARGE PIPE
M-1		19.15'		103.34'		X			11/6/90 NO protective casing 2" ID
M-2		11.30		24.69'		X			11/6/90 NO protective casing VENT PLUGGED
L-1		12.58		62.53	X	X			11/6/90 NO PROTECTIVE CASING, VENTED 5" ID, SILTY
L-2		10.46		186.91	X	X			11/6/90 NO PROTECTIVE CASING, VENTED 5" ID SILTY
L-4		11.73		18.91		X			11/6/90 NO PROTECTIVE CASING, VENT IS PLUGGED 2" ID NO LOCKING CAP
I-3		9.38		22.20	X	X			11/6/90 NO PROTECTIVE CASING, VENTED CAP 5" ID CASING
I-1		10.67		172.82	X	X			11/6/90 NO PROTECTIVE CASING, VENTED CAP, 5" ID CASING
I-2		9.05		15.64	NO	X			11/6/90 NO PROTECTIVE CASING, VENTED CAP 2" PVC
Q-1		5.87		23.69	NO	X			11/6/90 UNLOCKED FLUSH MOUNT WELL BOX NEXT TO HYDRANT. AEROSOL RED PAINT
D-1		11.65		42.70	X	X	X		11/6/90 NO PROTECTIVE CASING, VENTED CAP 5" ID PVC
D-3		23.18		153.62	X	X			" " "
J-2		9.76		17.58	NO	X			11/6/90 UNLOCKED, 2" ID PVC WELL VENTED CAP
F-2		17.06		147.85	X	X			11/6/90 NO PROTECTIVE CASING, VENTED CAP 5" ID PVC
F-3		20.34		180.20	X	X			" " " SILTY BOTTOM
F-1		9.15		31.25	NO	X			11/6/90 NO PROTECTOR, VENTED 2" PVC
G-1		13.75		46.97	X	X			11/6/90 NO PROTECTOR, VENTED CAP 5" ID PVC CASING
G-3		27.69		—	X	X			" " UNABLE TO DETERMINE TOTAL DEPTH
P-1		3.90		25.24	NO	NO			11/6/90 FLUSH MOUNT WELL BOX, [illegible]
O-1		10.19		29.77	X	X			11/6/90 FLUSH MOUNT WELL BOX [illegible] 2" ID PVC

DESCRIPTION OF SITE

SITE CONDITIONS

WEATHER TEMPERATURE

ENTERED ON COMPUTER SIGNATURE DATE

DONOHUE

WATER ELEVATION

FEB. 1, 1991

PROJECT NO. 20026 SITE Himco Dump

WELL NUMBER	ELEVATION OF TOP OF PIPE	DEPTH TO WATER Ft.	WATER ELEVATION	DEPTH TO BOTTOM Ft.	WELL INTEGRITY [illegible]	CAPPED	CRACKED	[illegible]	COMMENTS
A-1	762.63	6.25	757.39		X	X			1052 NO PROTECTIVE CASING
B-2	763.20	6.15	757.05	13.88		X			1055
B-3	764.67	7.44	757.23	130.34	X	X			1059
B-4	763.70	6.45	757.25	175.16	X	X			1110
CP-1	761.19	3.82	757.37	20.19		X			1013 2/2/91 NO PROTECTIVE CASING
E-2	771.15	9.82	761.33	11.54	[illegible]	X			~~1507~~ 1612 NO PROX. [illegible] AK 2/1/91
E-3	771.11	11.11	760.00	175.65	X	X			1614 2/1/91 NO protective casing
F-1		7.67		31.28		X			~~1553~~ 1755 NO protective casing
F-2		14.08		147.83	X	X			1438 NO PROTECTIVE CASING
F-5		16.98			X	X			1453 NO PROTECTIVE CASING
G-1		12.48		52.02	X	X			1413 NO PROTECTIVE CASING
G-3		22.08		169.39	X	X			1424 NO PROTECTIVE CASING CAP CRACKED
I-1		9.48		102.93	X	X			1540 NO PROTECTIVE CASING
I-2		8.98		15.60		X			1544
I-3		9.14		32.15	X	X			1832 NO PROTECTIVE CASING [illegible]
J-1		12.03		42.64	X	X			1514 NO PROTECTIVE CASING
J-2		10.29		17.81		X	X		1524 NO PROTECTIVE CASING
K-3		18.63		153.39	X	X			1520 NO PROTECTIVE CASING
M-1	770.32	15.61	754.71	103.24		X			1045 2/2/91 (N) NO PROTECT. CASING
M-2	769.46	14.84	754.62	24.76		X			1050 2/2/91 (S)
N-1		8.81		29.22		X			0949 2/2/91 FLUSH
Q-1		5.0		23.40		X			not [illegible] 1821)
O-1	763.33	8.34	754.99	29.99		X			~~0923~~ 0931 AK 2/2/91 [illegible]
WT101A	764.35	9.96	754.39	18.90	X	X			1145
P101B	764.29	9.89	754.40	100.49	X	X			1152
P101C	764.16	9.78	754.38	166.53	X	X			1159
WT106A	761.47	7.87	753.60	18.50	X	X			1558
WT105A	762.94	9.0	753.94	18.56	X	X			1625
WT104A	765.57	8.02	757.55	18.69	X	X			1635
WT103A	760.59	5.28	755.31	18.47	X	X			1001 2/2/91
WT102A	769.08	10.17	758.91	18.18	X	X			0851 2/3/91

DESCRIPTION OF SITE E1 1509 DTW = 11.38 DTB = 71.15

SOIL CONDITIONS O-1: Flush w/ground water make cover to side casing fill w/

WEATHER Mud, ice, water, cap not screwed on TEMPERATURE

ENTERED ON COMPUTER ____ SIGNATURE ____ DATE ____

DONOHUE

WATER ELEVATION

PROJECT NO. 20026 SITE HIMCO DUMP - INITIAL WELL INVENTORY

WELL NUMBER	ELEVATION OF TOP OF PIPE	DEPTH TO WATER	WATER ELEVATION	DEPTH TO BOTTOM	WELL INTEGRITY				COMMENTS Popper secured prior to 1st water level all initial wells
					[illegible]	[illegible]	CRACKED	[illegible]	
E-1?	721.11	12.15	/	81.38'	X	X			11/6/90 (Farthest North)
E-2		11.62'		17.49		X			11/6/90 (Middle) NO PROTECTIVE CASING
E-3		12.99'		175.58	X	X			11/6/90 5" ID (farthest south)
N-1		9.76'		29.25'		X			11/6/90 NOT locked
B-4		9.55'		175.12'	X	X			11/6/90 NO protective casing [illegible] 5" ID
B-3		8.34'		130.23	X	X			11/6/90 NO protective casing 5" ID
B-2		9.04'		13.91'		X			11/6/90 NO protective casing 2" ID
B-1		9.38'			X	X			11/6/90 NO protective casing (furthest west) 5" ID
CP-1	Unable to open					X			11/6/90 NO protective casing [illegible]
M-1		19.15'		103.34'		X			11/6/90 NO protective casing 2" ID
M-2		11.30		24.69'		X			11/6/90 NO protective casing VENT PLUGGED
L-1		12.58		62.53	X	X			11/6/90 NO PROTECTIVE CASING, VENTED 5" ID, SILTY
L-2		10.46		186.91	X	X			11/6/90 NO PROTECTIVE CASING, VENTED 5" ID SILTY
L-4		11.73		18.91		X			11/6/90 NO PROTECTIVE CASING, VENT IS PLUGGED 2" ID NO LOCKING CAP
I-3		9.38		22.20	X	X			11/6/90 NO PROTECTIVE CASING, VENTED CAP 5" ID CASING
I-1		10.67		172.82	X	X			11/6/90 NO PROTECTIVE CASING, VENTED CAP, 5" ID CASING
I-2		9.05		15.64	NO	X			11/6/90 NO PROTECTIVE CASING, VENTED CAP 2" PVC
Q-1		5.87		23.69	NO	X			11/6/90 UNLOCKED FLUSH MOUNT WELL BOX NEXT TO HYDRANT ACROSS FROM PAINT
D-1		11.65		42.70	X	X	X		11/6/90 NO PROTECTIVE CASING, VENTED CAP, 5" ID PVC
D-3		23.18		153.62	X	X			" "
D-2		9.76		17.58	NO	X			11/6/90 UNLOCKED, 2" ID PVC WELL VENTED CAP
F-2		17.06		147.85	X	X			11/6/90 NO PROTECTIVE CASING, VENTED CAP 5" ID PVC
F-3?		20.34		189.25	X	X			" " " SILTY BOTTOM
F-1?		9.15		31.25	NO	X			11/6/90 NO PROTECTOR, VENTED 2" PVC
G-1		13.75		46.87	X	X			11/6/90 NO PROTECTIVE VENTED CAP 5" ID [illegible]
G-3		27.68		—	X	X			" " UNABLE TO DETERMINE TOTAL DEPTH
CP-1		3.40		25.24	NO	NO			11/6/90 FLUSH MOUNT WELL BOX [illegible]
C-1		10.19		29.77	X	X			11/6/90 FLUSH MOUNT WELL BOX [illegible]

DESCRIPTION OF SITE

SITE CONDITIONS

WEATHER TEMPERATURE

ENTERED ON COMPUTER SIGNATURE DATE

Preliminary Report
HIMCO
Water Quality - Ground Water

Field Sample Number	EPA Sample Number	Sample Date	Chemical Name	Sample Concent.	Units	Qual.	Depth to top of Sample	Depth to bottom of Sample
HDWTF-1	5884E-61	13-DEC-90	Alkalinity, Total	78	mg/L			
HDWT101A	5884E-13	28-NOV-90	Alkalinity, Total	510	mg/L	J		
HDWTM-2	5884E-29	03-DEC-90	Alkalinity, Total	490	mg/L			
HDWTI-3	5884E-37	04-DEC-90	Alkalinity, Total	480	mg/L			
HDWTQ-1	5884E-19	29-NOV-90	Alkalinity, Total	460	mg/L			
HDWT106A	5884E-76	08-JAN-91	Alkalinity, Total	450	mg/L	J		
HDFDWTP101B	5884E-78	09-JAN-91	Alkalinity, Total	440	mg/L	J		
HDWTP101B	5884E-80	09-JAN-91	Alkalinity, Total	430	mg/L	J		
HDWTE-2	5884E-55	12-DEC-90	Alkalinity, Total	43	mg/L	J		
HDWT106A	5884E-01	27-NOV-90	Alkalinity, Total	420	mg/L			
HDWT104A	5884E-05	28-NOV-90	Alkalinity, Total	40	mg/L			
HDFDWT104A	5884E-07	28-NOV-90	Alkalinity, Total	40	mg/L			
HDWTE-3	5884E-57	12-DEC-90	Alkalinity, Total	[illegible]	mg/L			
HDWTB-1	5884E-41	04-DEC-90	Alkalinity, Total	253	mg/L			
HDWTM-1	5884E-45	05-DEC-90	Alkalinity, Total	240	mg/L			
HDWTJ-3	5884E-49	10-DEC-90	Alkalinity, Total	230	mg/L			
HDWTF-3	5884E-59	13-DEC-90	Alkalinity, Total	210	mg/L			
HDWTG-3	5884E-63	13-DEC-90	Alkalinity, Total	200	mg/L			
HDWTJ-2	5884E-23	03-DEC-90	Alkalinity, Total	20.5	mg/L			
HDFBWTO-1	5884E-33	03-DEC-90	Alkalinity, Total	2.9	mg/L			
HDWTP102B	5884E-70	07-JAN-91	Alkalinity, Total	190	mg/L	J		
HDWTJ-1	5884E-39	04-DEC-90	Alkalinity, Total	190	mg/L			
HDWTP102C	5884E-72	09-JAN-91	Alkalinity, Total	180	mg/L	J		
HDWTF-2	5884E-51	11-DEC-90	Alkalinity, Total	180	mg/L			
HDWTG-1	5884E-43	04-DEC-90	Alkalinity, Total	180	mg/L			
HDWTO-1	5884E-31	03-DEC-90	Alkalinity, Total	180	mg/L			
HDWT102A	5884E-67	07-JAN-91	Alkalinity, Total	170	mg/L	J		
HDWTB-4	5884E-53	11-DEC-90	Alkalinity, Total	160	mg/L			
HDWTI-1	5884E-65	13-DEC-90	Alkalinity, Total	160	mg/L			
HDWTI-2	5884E-17	29-NOV-90	Alkalinity, Total	150	mg/L			
HDWT102A	5884E-11	28-NOV-90	Alkalinity, Total	150	mg/L			

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HDWTB-3	5884E-47	05-DEC-90	Alkalinity, Total	150	mg/L			
HDWT105A	5884E-74	08-JAN-91	Alkalinity, Total	140	mg/L	J		
HDWTN-1	5884E-21	29-NOV-90	Alkalinity, Total	140	mg/L			
HDWT105A	5884E-03	29-NOV-90	Alkalinity, Total	140	mg/L			
HDWT103A	5884E-09	28-NOV-90	Alkalinity, Total	130	mg/L			
HDWTCP-1	5884E-25	03-DEC-90	Alkalinity, Total	120	mg/L			
HDFDCP-1	5884E-27	03-DEC-90	Alkalinity, Total	120	mg/L			
HDWTB-2	5884E-35	04-DEC-90	Alkalinity, Total	110	mg/L			
HDWTM-2	5884E-30	03-DEC-90	Bromide, Dissolved	3.5	mg/L			
HDWTI-3	5884E-38	04-DEC-90	Bromide, Dissolved	2.2	mg/L			
HDWTE-3	5884E-58	12-DEC-90	Bromide, Dissolved	1.9	mg/L			
HDWTQ-1	5884E-20	29-NOV-90	Bromide, Dissolved	1.1	mg/L			
HDWT101A	5884E-14	28-NOV-90	Bromide, Dissolved	1.0	mg/L			
HDWTP101C	5884E-81	09-JAN-91	Bromide, Dissolved	0.9	mg/L			
HDWT106A	5884E-02	27-NOV-90	Bromide, Dissolved	0.8	mg/L			
HDWT106A	5884E-75	08-JAN-91	Bromide, Dissolved	0.8	mg/L			
HDFDWTP101B	5884E-77	09-JAN-91	Bromide, Dissolved	[illegible]	mg/L			
HDWTP101B	5884E-79	09-JAN-91	Bromide, Dissolved	0.4	mg/L			
HDWTF-2	5884E-52	11-DEC-90	Bromide, Dissolved	0.3	mg/L			
HDWTE-2	5884E-56	12-DEC-90	Bromide, Dissolved	0.2	mg/L			
HDWTP102B	5884E-69	07-JAN-91	Bromide, Dissolved	0.2	mg/L			
HDWTM-1	5884E-46	05-DEC-90	Bromide, Dissolved	0.2	mg/L			
HDWTF-3	5884E-60	13-DEC-90	Bromide, Dissolved	0.2	mg/L			
HDWTF-1	5884E-62	13-DEC-90	Bromide, Dissolved	0.2	mg/L			
HDWTJ-2	5884E-24	03-DEC-90	Bromide, Dissolved	0.2	mg/L			
HDWTB-1	5884E-42	04-DEC-90	Bromide, Dissolved	0.2	mg/L			
HDWTJ-1	5884E-40	04-DEC-90	Bromide, Dissolved	0.2	mg/L			
HDWT105A	5884E-04	29-NOV-90	Bromide, Dissolved	0.2	mg/L			
HDWTG-3	5884E-64	13-DEC-90	Bromide, Dissolved	0.1	mg/L			
HDWTP102C	5884E-71	09-JAN-91	Bromide, Dissolved	0.1	mg/L			
HDWT102A	5884E-68	07-JAN-91	Bromide, Dissolved	0.1	mg/L			

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HDFDCP-1	5884E-28	03-DEC-90	Bromide, Dissolved	0.1	mg/L			
HDWTI-2	5884E-18	29-NOV-90	Bromide, Dissolved	0.1	mg/L			
HDWTJ-3	5884E-50	10-DEC-90	Bromide, Dissolved	0.1	mg/L			
HDWT106A	5884E-76	08-JAN-91	COD	6.2	mg/L	J		
HDWTI-1	5884E-65	13-DEC-90	COD	15	mg/L	J		
HDWTF-1	5884E-61	13-DEC-90	COD	14	mg/L	J		
HDWTF-2	5884E-51	11-DEC-90	Chloride, Cl	<5.0	mg/L	J		
HDWTE-2	5884E-55	12-DEC-90	Chloride, Cl	<5.0	mg/L	J		
HDWT105A	5884E-03	29-NOV-90	Chloride, Cl	9.9	mg/L			
HDWTJ-1	5884E-39	04-DEC-90	Chloride, Cl	72	mg/L	J		
HDWTP102B	5884E-70	07-JAN-91	Chloride, Cl	70	mg/L	J		
HDWTB-1	5884E-41	04-DEC-90	Chloride, Cl	61	mg/L	J		
HDWTF-1	5884E-61	13-DEC-90	Chloride, Cl	6.7	mg/L	J		
HDWTI-1	5884E-65	13-DEC-90	Chloride, Cl	6.2	mg/L	J		
HDWTB-2	5884E-35	04-DEC-90	Chloride, Cl	5.9	mg/L	J		
HDWT105A	5884E-74	08-JAN-91	Chloride, Cl	5.8	mg/L	J		
HDWTQ-1	5884E-19	29-NOV-90	Chloride, Cl	42	mg/L			
HDWTE-3	5884E-57	12-DEC-90	Chloride, Cl	40	mg/L	J		
HDWT101A	5884E-13	28-NOV-90	Chloride, Cl	34	mg/L			
HDFDWTP101B	5884E-78	09-JAN-91	Chloride, Cl	33	mg/L	J		
HDWTP101B	5884E-80	09-JAN-91	Chloride, Cl	33	mg/L	J		
HDWTI-3	5884E-37	04-DEC-90	Chloride, Cl	29	mg/L	J		
HDWT106A	5884E-76	08-JAN-91	Chloride, Cl	27	mg/L	J		
HDWTO-1	5884E-31	03-DEC-90	Chloride, Cl	260	mg/L	J		
HDWT106A	5884E-01	27-NOV-90	Chloride, Cl	24	mg/L			
HDWT103A	5884E-09	28-NOV-90	Chloride, Cl	22	mg/L			
HDWTP102C	5884E-72	09-JAN-91	Chloride, Cl	21	mg/L	J		
HDWTN-1	5884E-21	29-NOV-90	Chloride, Cl	2.9	mg/L			
HDWTM-2	5884E-29	03-DEC-90	Chloride, Cl	18	mg/L	J		
HDWTG-1	5884E-43	04-DEC-90	Chloride, Cl	16	mg/L	J		
HDWTB-4	5884E-53	11-DEC-90	Chloride, Cl	16	mg/L	J		

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Field Sample Number	EPA Sample Number	Sample Date	Chemical Name	Sample Concent.	Units	Qual.	Depth to top of Sample	Depth to bottom of Sample
HDWTF-3	5884E-59	13-DEC-90	Chloride, Cl	16	mg/L	J		
HDFDCP-1	5884E-27	03-DEC-90	Chloride, Cl	15	mg/L			
HDWTJ-3	5884E-49	10-DEC-90	Chloride, Cl	15	mg/L	J		
HDWTCP-1	5884E-25	03-DEC-90	Chloride, Cl	15	mg/L			
HDWTJ-2	5884E-23	03-DEC-90	Chloride, Cl	130	mg/L	J		
HDWT102A	5884E-11	28-NOV-90	Chloride, Cl	120	mg/L			
HDWTI-2	5884E-17	29-NOV-90	Chloride, Cl	12	mg/L			
HDFDWT104A	5884E-07	28-NOV-90	Chloride, Cl	12	mg/L			
HDWT104A	5884E-05	28-NOV-90	Chloride, Cl	12	mg/L			
HDWTP101C	5884E-82	09-JAN-91	Chloride, Cl	11	mg/L	J		
HDWT102A	5884E-67	07-JAN-91	Chloride, Cl	100	mg/L	J		
HDFBWTO-1	5884E-33	03-DEC-90	Chloride, Cl	0.2	mg/L	J		
HDFBWT105A	5884E-15	29-NOV-90	Chloride, Cl	0.16	mg/L	J		
HDFDWTP101B	5884E-78	09-JAN-91	Nitrogen, Ammonia (NH3)	[illegible]	mg/L			
HDWTP101B	5884E-80	09-JAN-91	Nitrogen, Ammonia (NH3)	4.2	mg/L			
HDWTM-1	5884E-45	05-DEC-90	Nitrogen, Ammonia (NH3)	4.0	mg/L	J		
HDWTM-2	5884E-29	03-DEC-90	Nitrogen, Ammonia (NH3)	30	mg/L	J		
HDWTN-1	5884E-21	29-NOV-90	Nitrogen, Ammonia (NH3)	2.8	mg/L	J		
HDWTI-3	5884E-37	04-DEC-90	Nitrogen, Ammonia (NH3)	2.2	mg/L	J		
HDWT101A	5884E-13	28-NOV-90	Nitrogen, Ammonia (NH3)	18	mg/L	J		
HDWTQ-1	5884E-19	29-NOV-90	Nitrogen, Ammonia (NH3)	16	mg/L	J		
HDWT106A	5884E-76	08-JAN-91	Nitrogen, Ammonia (NH3)	14	mg/L			
HDWT106A	5884E-01	27-NOV-90	Nitrogen, Ammonia (NH3)	14	mg/L	J		
HDWT105A	5884E-03	29-NOV-90	Nitrogen, Ammonia (NH3)	1.5	mg/L	J		
HDWT104A	5884E-05	28-NOV-90	Nitrogen, Ammonia (NH3)	0.5	mg/L	J		
HDWTP101C	5884E-82	09-JAN-91	Nitrogen, Ammonia (NH3)	0.49	mg/L	J		
HDWTJ-3	5884E-49	10-DEC-90	Nitrogen, Ammonia (NH3)	0.44	mg/L	J		
HDWTB-3	5884E-47	05-DEC-90	Nitrogen, Ammonia (NH3)	0.40	mg/L	J		
HDWTCP-1	5884E-25	03-DEC-90	Nitrogen, Ammonia (NH3)	0.24	mg/L	J		
HDWT102A	5884E-67	07-JAN-91	Nitrogen, Ammonia (NH3)	0.22	mg/L	J		
HDWTB-1	5884E-41	04-DEC-90	Nitrogen, Ammonia (NH3)	0.21	mg/L	J		

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HDWTG-1	5884E-43	04-DEC-90	Nitrogen, Ammonia (NH3)	0.20	mg/L	J		
HDWTF-2	5884E-51	11-DEC-90	Nitrogen, Ammonia (NH3)	0.19	mg/L	J		
HDWTF-3	5884E-59	13-DEC-90	Nitrogen, Ammonia (NH3)	0.18	mg/L	J		
HDWTI-1	5884E-65	13-DEC-90	Nitrogen, Ammonia (NH3)	0.14	mg/L	J		
HDWTP102B	5884E-70	07-JAN-91	Nitrogen, Ammonia (NH3)	0.11	mg/L	J		
HDWTJ-1	5884E-39	04-DEC-90	Nitrogen, Ammonia (NH3)	0.11	mg/L	J		
HDWT105A	5884E-74	08-JAN-91	Nitrogen, Ammonia (NH3)	0.11	mg/L	J		
HDWTP102C	5884E-72	09-JAN-91	Nitrogen, Ammonia (NH3)	0.10	mg/L	J		
HDWT102A	5884E-67	07-JAN-91	Nitrogen, Nitrate + Nitrite (NO2 + NO3)	6.9	mg/L	J		
HDWT105A	5884E-74	08-JAN-91	Nitrogen, Nitrate + Nitrite (NO2 + NO3)	1.6	mg/L			
HDWTE-3	5884E-57	12-DEC-90	Nitrogen, Nitrate + Nitrite (NO2 + NO3)	0.48	mg/L	J		
HDWTG-3	5884E-63	13-DEC-90	Nitrogen, Nitrate + Nitrite (NO2 + NO3)	0.15	mg/L	J		
HDWT106A	5884E-76	08-JAN-91	Nitrogen, Nitrate + Nitrite (NO2 + NO3)	0.14	mg/L			
HDWTB-2	5884E-35	04-DEC-90	Sulfate, SO4	94	mg/L	J		
HDWTP101C	5884E-82	09-JAN-91	Sulfate, SO4	80	mg/L	J		
HDWTJ-1	5884E-39	04-DEC-90	Sulfate, SO4	7[illegible]	mg/L	J		
HDWTJ-2	5884E-23	03-DEC-90	Sulfate, SO4	67	mg/L	J		
HDWTI-3	5884E-37	04-DEC-90	Sulfate, SO4	65	mg/L	J		
HDWTP102B	5884E-70	07-JAN-91	Sulfate, SO4	64	mg/L	J		
HDWTG-1	5884E-43	04-DEC-90	Sulfate, SO4	64	mg/L	J		
HDWTM-2	5884E-29	03-DEC-90	Sulfate, SO4	6	mg/L	J		
HDWT106A	5884E-01	27-NOV-90	Sulfate, SO4	56	mg/L			
HDWT106A	5884E-76	08-JAN-91	Sulfate, SO4	54	mg/L	J		
HDWT104A	5884E-05	28-NOV-90	Sulfate, SO4	5.9	mg/L			
HDFDWT104A	5884E-07	28-NOV-90	Sulfate, SO4	5.9	mg/L			
HDWT102A	5884E-11	28-NOV-90	Sulfate, SO4	430	mg/L			
HDWTB-4	5884E-53	11-DEC-90	Sulfate, SO4	38	mg/L	J		
HDWT102A	5884E-67	07-JAN-91	Sulfate, SO4	360	mg/L	J		
HDWTP102C	5884E-72	09-JAN-91	Sulfate, SO4	35	mg/L	J		
HDWTI-2	5884E-17	29-NOV-90	Sulfate, SO4	33	mg/L			
HDWT105A	5884E-03	29-NOV-90	Sulfate, SO4	30	mg/L			

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HDWTN-1	5884E-21	29-NOV-90	Sulfate, SO4	25	mg/L			
HDWT105A	5884E-74	08-JAN-91	Sulfate, SO4	22	mg/L	J		
HDWTCP-1	5884E-25	03-DEC-90	Sulfate, SO4	190	mg/L			
HDFDCP-1	5884E-27	03-DEC-90	Sulfate, SO4	190	mg/L			
HDWTF-2	5884E-51	11-DEC-90	Sulfate, SO4	18	mg/L	J		
HDWT103A	5884E-09	28-NOV-90	Sulfate, SO4	170	mg/L			
HDWTQ-1	5884E-19	29-NOV-90	Sulfate, SO4	160	mg/L			
HDWT101A	5884E-13	28-NOV-90	Sulfate, SO4	150	mg/L			
HDWTF-1	5884E-61	13-DEC-90	Sulfate, SO4	15	mg/L	J		
HDFDWTP101B	5884E-78	09-JAN-91	Sulfate, SO4	140	mg/L	J		
HDWTP101B	5884E-80	09-JAN-91	Sulfate, SO4	140	mg/L	J		
HDWTO-1	5884E-31	03-DEC-90	Sulfate, SO4	140	mg/L	J		
HDWTE-2	5884E-55	12-DEC-90	Sulfate, SO4	13	mg/L	J		
HDWTE-3	5884E-57	12-DEC-90	Sulfate, SO4	110	mg/L	J		
HDWTJ-2	5884E-23	03-DEC-90	TDS (Total Dissolved Solids)	940	mg/L	J		
HDWT102A	5884E-11	28-NOV-90	TDS (Total Dissolved Solids)	910	mg/L	J		
HDWTB-3	5884E-47	05-DEC-90	TDS (Total Dissolved Solids)	840	mg/L	J		
HDWT102A	5884E-67	07-JAN-91	TDS (Total Dissolved Solids)	820	mg/L	J		
HDWTP101C	5884E-82	09-JAN-91	TDS (Total Dissolved Solids)	790	mg/L	J		
HDWTM-1	5884E-45	05-DEC-90	TDS (Total Dissolved Solids)	750	mg/L	J		
HDWTQ-1	5884E-19	29-NOV-90	TDS (Total Dissolved Solids)	620	mg/L	J		
HDWTP101B	5884E-80	09-JAN-91	TDS (Total Dissolved Solids)	610	mg/L	J		
HDWTI-3	5884E-37	04-DEC-90	TDS (Total Dissolved Solids)	610	mg/L	J		
HDFDWTP101B	5884E-78	09-JAN-91	TDS (Total Dissolved Solids)	600	mg/L	J		
HDWT106A	5884E-76	08-JAN-91	TDS (Total Dissolved Solids)	480	mg/L	J		
HDWTE-3	5884E-57	12-DEC-90	TDS (Total Dissolved Solids)	480	mg/L	J		
HDWT106A	5884E-01	27-NOV-90	TDS (Total Dissolved Solids)	450	mg/L	J		
HDWTM-2	5884E-29	03-DEC-90	TDS (Total Dissolved Solids)	450	mg/L	J		
HDWTJ-1	5884E-39	04-DEC-90	TDS (Total Dissolved Solids)	430	mg/L	J		
HDWTI-2	5884E-17	29-NOV-90	TDS (Total Dissolved Solids)	430	mg/L	J		
HDWT103A	5884E-09	28-NOV-90	TDS (Total Dissolved Solids)	420	mg/L	J		

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HDWTO-1	5884E-31	03-DEC-90	TDS (Total Dissolved Solids)	410	mg/L	J		
HDWT101A	5884E-13	28-NOV-90	TDS (Total Dissolved Solids)	400	mg/L	J		
HDWT105A	5884E-03	29-NOV-90	TDS (Total Dissolved Solids)	370	mg/L	J		
HDWTP102B	5884E-70	07-JAN-91	TDS (Total Dissolved Solids)	370	mg/L	J		
HDWTB-1	5884E-41	04-DEC-90	TDS (Total Dissolved Solids)	360	mg/L	J		
HDWTB-2	5884E-35	04-DEC-90	TDS (Total Dissolved Solids)	330	mg/L	J		
HDFBWTO-1	5884E-33	03-DEC-90	TDS (Total Dissolved Solids)	33	mg/L	J		
HDWTG-1	5884E-43	04-DEC-90	TDS (Total Dissolved Solids)	320	mg/L	J		
HDWTG-3	5884E-63	13-DEC-90	TDS (Total Dissolved Solids)	280	mg/L	J		
HDWTP102C	5884E-72	09-JAN-91	TDS (Total Dissolved Solids)	250	mg/L	J		
HDWTB-4	5884E-53	11-DEC-90	TDS (Total Dissolved Solids)	250	mg/L	J		
HDWTF-3	5884E-59	13-DEC-90	TDS (Total Dissolved Solids)	240	mg/L	J		
HDWTJ-3	5884E-49	10-DEC-90	TDS (Total Dissolved Solids)	240	mg/L	J		
HDWTF-2	5884E-51	11-DEC-90	TDS (Total Dissolved Solids)	230	mg/L	J		
HDWTI-1	5884E-65	13-DEC-90	TDS (Total Dissolved Solids)	230	mg/L	J		
HDWTN-1	5884E-21	29-NOV-90	TDS (Total Dissolved Solids)	200	mg/L	J		
HDWT105A	5884E-74	08-JAN-91	TDS (Total Dissolved Solids)	170	mg/L	J		
HDWTE-2	5884E-55	12-DEC-90	TDS (Total Dissolved Solids)	160	mg/L	J		
HDWTCP-1	5884E-25	03-DEC-90	TDS (Total Dissolved Solids)	1500	mg/L	J		
HDFDWT104A	5884E-07	28-NOV-90	TDS (Total Dissolved Solids)	150	mg/L	J		
HDFDCP-1	5884E-27	03-DEC-90	TDS (Total Dissolved Solids)	1300	mg/L	J		
HDWTF-1	5884E-61	13-DEC-90	TDS (Total Dissolved Solids)	120	mg/L	J		
HDWT104A	5884E-05	28-NOV-90	TDS (Total Dissolved Solids)	120	mg/L	J		
HDFBWT105A	5884E-15	29-NOV-90	TDS (Total Dissolved Solids)	[illegible]	mg/L	J		
HDWT106A	5884E-01	27-NOV-90	TKN (Total Kjeldahl Nitrogen)	9.1	mg/L	J		
HDWTM-2	5884E-29	03-DEC-90	TKN (Total Kjeldahl Nitrogen)	41	mg/L	J		
HDWTM-1	5884E-45	05-DEC-90	TKN (Total Kjeldahl Nitrogen)	4.8	mg/L	J		
HDFDWTP101B	5884E-78	09-JAN-91	TKN (Total Kjeldahl Nitrogen)	4.4	mg/L	J		
HDWTP101B	5884E-80	09-JAN-91	TKN (Total Kjeldahl Nitrogen)	3.9	mg/L	J		
HDWTN-1	5884E-21	29-NOV-90	TKN (Total Kjeldahl Nitrogen)	3.6	mg/L	J		
HDWTI-3	5884E-37	04-DEC-90	TKN (Total Kjeldahl Nitrogen)	2.3	mg/L	J		

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Field Sample Number	EPA Sample Number	Sample Date	Chemical Name	Sample Concent.	Units	Qual.	Depth to top of Sample	Depth to bottom of Sample
HDFDCP-1	5884E-27	03-DEC-90	TKN (Total Kjeldahl Nitrogen)	2.2	mg/L	J		
HDWT101A	5884E-13	28-NOV-90	TKN (Total Kjeldahl Nitrogen)	17	mg/L	J		
HDWTQ-1	5884E-19	29-NOV-90	TKN (Total Kjeldahl Nitrogen)	17	mg/L	J		
HDWT106A	5884E-76	08-JAN-91	TKN (Total Kjeldahl Nitrogen)	14	mg/L	J		
HDFBWT105A	5884E-15	29-NOV-90	TKN (Total Kjeldahl Nitrogen)	1.6	mg/L	J		
HDWTB-2	5884E-35	04-DEC-90	TKN (Total Kjeldahl Nitrogen)	1.2	mg/L	J		
HDWTP102B	5884E-70	07-JAN-91	TKN (Total Kjeldahl Nitrogen)	1.0	mg/L	J		
HDWTG-1	5884E-43	04-DEC-90	TKN (Total Kjeldahl Nitrogen)	0.88	mg/L	J		
HDWT105A	5884E-74	08-JAN-91	TKN (Total Kjeldahl Nitrogen)	0.85	mg/L	J		
HDWTI-2	5884E-17	29-NOV-90	TKN (Total Kjeldahl Nitrogen)	0.8	mg/L	J		
HDWTP101C	5884E-82	09-JAN-91	TKN (Total Kjeldahl Nitrogen)	0.79	mg/L	J		
HDFDWT104A	5884E-07	28-NOV-90	TKN (Total Kjeldahl Nitrogen)	0.72	mg/L	J		
HDFBWTO-1	5884E-33	03-DEC-90	TKN (Total Kjeldahl Nitrogen)	0.58	mg/L	J		
HDWTB-1	5884E-41	04-DEC-90	TKN (Total Kjeldahl Nitrogen)	0.55	mg/L	J		
HDWT105A	5884E-03	29-NOV-90	TKN (Total Kjeldahl Nitrogen)	0.49	mg/L	J		
HDWTCP-1	5884E-25	03-DEC-90	TKN (Total Kjeldahl Nitrogen)	0.33	mg/L	J		
HDWTP102C	5884E-72	09-JAN-91	TKN (Total Kjeldahl Nitrogen)	0.28	mg/L	J		
HDWT102A	5884E-67	07-JAN-91	TKN (Total Kjeldahl Nitrogen)	0.27	mg/L	J		
HDWT104A	5884E-05	28-NOV-90	TKN (Total Kjeldahl Nitrogen)	0.26	mg/L	J		
HDWTJ-1	5884E-39	04-DEC-90	TKN (Total Kjeldahl Nitrogen)	0.22	mg/L	J		
HDWTO-1	5884E-31	03-DEC-90	TKN (Total Kjeldahl Nitrogen)	0.2	mg/L	J		
HDWT102A	5884E-11	28-NOV-90	TKN (Total Kjeldahl Nitrogen)	0.18	mg/L	J		
HDWTB-3	5884E-47	05-DEC-90	TKN (Total Kjeldahl Nitrogen)	0.15	mg/L	J		
HDWT103A	5884E-09	28-NOV-90	TKN (Total Kjeldahl Nitrogen)	0.12	mg/L	J		
HDWTJ-2	5884E-23	03-DEC-90	TP (Total Phosphorus)	0.40	mg/L	J		
HDWTG-3	5884E-63	13-DEC-90	TP (Total Phosphorus)	0.32	mg/L	J		
HDWTF-3	5884E-59	13-DEC-90	TP (Total Phosphorus)	0.30	mg/L	J		
HDWTM-2	5884E-29	03-DEC-90	TP (Total Phosphorus)	0.27	mg/L	J		
HDWT102A	5884E-11	28-NOV-90	TP (Total Phosphorus)	0.27	mg/L	J		
HDWT104A	5884E-05	28-NOV-90	TP (Total Phosphorus)	0.23	mg/L	J		
HDWTQ-1	5884E-19	29-NOV-90	TP (Total Phosphorus)	0.23	mg/L	J		

PRELIMINARY

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HIMCO
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Field Sample Number	EPA Sample Number	Sample Date	Chemical Name	Sample Concent.	Units	Qual.	Depth to top of Sample	Depth to bottom of Sample
HDWT101A	5884E-13	28-NOV-90	TP (Total Phosphorus)	0.21	mg/L	J		
HDWTN-1	5884E-21	29-NOV-90	TP (Total Phosphorus)	0.19	mg/L	J		
HDFDWT104A	5884E-07	28-NOV-90	TP (Total Phosphorus)	0.19	mg/L	J		
HDWT105A	5884E-03	29-NOV-90	TP (Total Phosphorus)	0.19	mg/L	J		
HDWTJ-1	5884E-39	04-DEC-90	TP (Total Phosphorus)	0.17	mg/L	J		
HDWTI-2	5884E-17	29-NOV-90	TP (Total Phosphorus)	0.15	mg/L	J		
HDWTB-2	5884E-35	04-DEC-90	TP (Total Phosphorus)	0.12	mg/L	J		
HDWT103A	5884E-09	28-NOV-90	TP (Total Phosphorus)	0.09	mg/L	J		
HDWTB-2	5884E-35	04-DEC-90	TSS (Total Suspended Solids)	9.0	mg/L	J		
HDWTG-1	5884E-43	04-DEC-90	TSS (Total Suspended Solids)	9.0	mg/L	J		
HDWTM-1	5884E-45	05-DEC-90	TSS (Total Suspended Solids)	8.0	mg/L	J		
HDWTP101C	5884E-82	09-JAN-91	TSS (Total Suspended Solids)	62	mg/L	J		
HDWTM-2	5884E-29	03-DEC-90	TSS (Total Suspended Solids)	6.0	mg/L	J		
HDWTF-1	5884E-61	13-DEC-90	TSS (Total Suspended Solids)	6.0	mg/L	J		
HDWT104A	5884E-05	28-NOV-90	TSS (Total Suspended Solids)	5.0	mg/L	J		
HDWTI-2	5884E-17	29-NOV-90	TSS (Total Suspended Solids)	4.0	mg/L	J		
HDWTP101B	5884E-80	09-JAN-91	TSS (Total Suspended Solids)	36	mg/L	J		
HDWTE-2	5884E-55	12-DEC-90	TSS (Total Suspended Solids)	350	mg/L	J		
HDFDWTP101B	5884E-78	09-JAN-91	TSS (Total Suspended Solids)	32.0	mg/L	J		
HDWTN-1	5884E-21	29-NOV-90	TSS (Total Suspended Solids)	3.0	mg/L	J		
HDWT106A	5884E-01	27-NOV-90	TSS (Total Suspended Solids)	3.0	mg/L	J		
HDFDCP-1	5884E-27	03-DEC-90	TSS (Total Suspended Solids)	3.0	mg/L	J		
HDFBWT105A	5884E-15	29-NOV-90	TSS (Total Suspended Solids)	3.0	mg/L	J		
HDWTF-3	5884E-59	13-DEC-90	TSS (Total Suspended Solids)	28	mg/L	J		
HDWTJ-3	5884E-49	10-DEC-90	TSS (Total Suspended Solids)	24	mg/L	J		
HDWTB-1	5884E-41	04-DEC-90	TSS (Total Suspended Solids)	18	mg/L	J		
HDWTG-3	5884E-63	13-DEC-90	TSS (Total Suspended Solids)	17	mg/L	J		
HDWT106A	5884E-76	08-JAN-91	TSS (Total Suspended Solids)	15	mg/L	J		
HDWTB-4	5884E-53	11-DEC-90	TSS (Total Suspended Solids)	12	mg/L	J		
HDWTE-3	5884E-57	12-DEC-90	TSS (Total Suspended Solids)	110	mg/L	J		
HDWTI-1	5884E-65	13-DEC-90	TSS (Total Suspended Solids)	11	mg/L	J		

PRELIMINARY

MONDAY MAY 6, 1991 8:38 AM CENTRAL TIME

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Field Sample Number	EPA Sample Number	Sample Date	Chemical Name	Sample Concent.	Units	Qual.	Depth to top of Sample	Depth to bottom of Sample
HDWTF-2	5884E-51	11-DEC-90	TSS (Total Suspended Solids)	10	mg/L	J		
HDWT101A	5884E-13	28-NOV-90	TSS (Total Suspended Solids)	.53	mg/L	J		

PRELIMINARY

MONDAY MAY 6, 1991 8:38 AM CENTRAL TIME
ELAPSED: 0 00:02:35.76 CPU: 0:00:43.79 BUFIO: 47 DIRIO: 1140 FAULTS: 3500

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HIMCO
Water Quality - Surface Water

Field Sample Number	EPA Sample Number	Sample Date	Chemical Name	Sample Concent.	Units	Qual.	Depth to top of Sample	Depth to bottom of Sample
HDSS07-01	5756E-18	18-OCT-90	Alkalinity, Total	158	mg/L			
HDSS08-01	5756E-26	19-OCT-90	Alkalinity, Total	158	mg/L			
HDSS06-01	5756E-17	18-OCT-90	Alkalinity, Total	143	mg/L			
HDSS05-01	5756E-16	18-OCT-90	Alkalinity, Total	138	mg/L			
HDFDSS11-01	5756E-30	19-OCT-90	Alkalinity, Total	130	mg/L			
HDSS11-01	5756E-29	19-OCT-90	Alkalinity, Total	127	mg/L			
HDSS01-01	5756E-04	17-OCT-90	Alkalinity, Total	122	mg/L			
HDSS10-01	5756E-28	19-OCT-90	Alkalinity, Total	120	mg/L			
HDSS12-01	5756E-31	19-OCT-90	Alkalinity, Total	120	mg/L			
HDSS09-01	5756E-27	19-OCT-90	Alkalinity, Total	117	mg/L			
HDSS03-01	5756E-14	18-OCT-90	Alkalinity, Total	113	mg/L			
HDFDSS01	5756E-06	17-OCT-90	Alkalinity, Total	104	mg/L			
HDSS02-01	5756E-08	18-OCT-90	Alkalinity, Total	90	mg/L			
HDSS04-0	5756E-15	18-OCT-90	Alkalinity, Total	90	mg/L			
HDSS10-01	5756E-21	19-OCT-90	Bromide, Dissolved	0.1	mg/L			
HDSS11-01	5756E-22	19-OCT-90	Bromide, Dissolved	0.1	mg/L			
HDFDSS11-01	5756E-23	19-OCT-90	Bromide, Dissolved	0.1	mg/L			
HDSS09-01	5756E-20	19-OCT-90	Bromide, Dissolved	0.1	mg/L			
HDFDSS01	5756E-06	17-OCT-90	COD	42	mg/L	J		
HDSS07-01	5756E-18	18-OCT-90	COD	23	mg/L	J		
HDSS08-01	5756E-26	19-OCT-90	COD	6	mg/L	J		
HDSS01-01	5756E-04	17-OCT-90	COD	5	mg/l	J		
HDSS04-0	5756E-15	18-OCT-90	Chloride, Cl	38	mg/L			
HDSS10-01	5756E-28	19-OCT-90	Chloride, Cl	34	mg/L			
HDSS11-01	5756E-29	19-OCT-90	Chloride, Cl	34	mg/L			
HDSS09-01	5756E-27	19-OCT-90	Chloride, Cl	33	mg/L			
HDSS12-01	5756E-31	19-OCT-90	Chloride, Cl	33	mg/L			
HDFDSS11-01	5756E-30	19-OCT-90	Chloride, Cl	33	mg/L			
HDSS02-01	5756E-08	18-OCT-90	Chloride, Cl	24	mg/L			
HDSS03-01	5756E-14	18-OCT-90	Chloride, Cl	24	mg/L			
HDSS01-01	5756E-04	17-OCT-90	Chloride, Cl	22	mg/L			

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Field Sample Number	EPA Sample Number	Sample Date	Chemical Name	Sample Concent.	Units	Qual.	Depth to top of Sample	Depth to bottom of Sample
HDSS05-01	5756E-16	18-OCT-90	Chloride, Cl	21	mg/L			
HDSS06-01	5756E-17	18-OCT-90	Chloride, Cl	21	mg/L			
HDFDSS01	5756E-06	17-OCT-90	Chloride, Cl	21	mg/L			
HDSS08-01	5756E-26	19-OCT-90	Chloride, Cl	21	mg/L			
HDSS07-01	5756E-18	18-OCT-90	Chloride, Cl	19	mg/L			
HDSS09-01	5756E-27	19-OCT-90	Nitrogen, Nitrate + Nitrite (NO2 + NO3)	0.76	mg/L			
HDFDSS11-01	5756E-30	19-OCT-90	Nitrogen, Nitrate + Nitrite (NO2 + NO3)	0.70	mg/L			
HDSS10-01	5756E-28	19-OCT-90	Nitrogen, Nitrate + Nitrite (NO2 + NO3)	0.69	mg/L			
HDSS11-01	5756E-29	19-OCT-90	Nitrogen, Nitrate + Nitrite (NO2 + NO3)	0.67	mg/L			
HDFDSS01	5756E-06	17-OCT-90	Nitrogen, Nitrate + Nitrite (NO2 + NO3)	0.31	mg/L			
HDSS01-01	5756E-04	17-OCT-90	Nitrogen, Nitrate + Nitrite (NO2 + NO3)	0.30	mg/L			
HDSS02-01	5756E-08	18-OCT-90	Nitrogen, Nitrate + Nitrite (NO2 + NO3)	0.21	mg/L			
HDSS03-01	5756E-14	18-OCT-90	Nitrogen, Nitrate + Nitrite (NO2 + NO3)	0.17	mg/L			
HDSS04-0	5756E-15	18-OCT-90	Nitrogen, Nitrate + Nitrite (NO2 + NO3)	0.17	mg/L			
HDSS02-01	5756E-08	18-OCT-90	Sulfate, SO4	155	mg/L			
HDSS05-01	5756E-16	18-OCT-90	Sulfate, SO4	155	mg/L			
HDFDSS01	5756E-06	17-OCT-90	Sulfate, SO4	150	mg/L			
HDSS03-01	5756E-14	18-OCT-90	Sulfate, SO4	146	mg/L			
HDSS01-01	5756E-04	17-OCT-90	Sulfate, SO4	145	mg/L			
HDSS04-0	5756E-15	18-OCT-90	Sulfate, SO4	145	mg/L			
HDSS10-01	5756E-28	19-OCT-90	Sulfate, SO4	130	mg/L			
HDFDSS11-01	5756E-30	19-OCT-90	Sulfate, SO4	125	mg/L			
HDSS12-01	5756E-31	19-OCT-90	Sulfate, SO4	125	mg/L			
HDSS09-01	5756E-27	19-OCT-90	Sulfate, SO4	120	mg/L			
HDSS11-01	5756E-29	19-OCT-90	Sulfate, SO4	120	mg/L			
HDSS06-01	5756E-17	18-OCT-90	Sulfate, SO4	100	mg/L			
HDSS08-01	5756E-26	19-OCT-90	Sulfate, SO4	100	mg/L			
HDSS07-01	5756E-18	18-OCT-90	Sulfate, SO4	42	mg/L			
HDSS02-01	5756E-08	18-OCT-90	TDS (Total Dissolved Solids)	384	mg/L			
HDSS12-01	5756E-31	19-OCT-90	TDS (Total Dissolved Solids)	372	mg/L			
HDFDSS01	5756E-06	17-OCT-90	TDS (Total Dissolved Solids)	371	mg/L			

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Water Quality - Surface Water

Field Sample Number	EPA Sample Number	Sample Date	Chemical Name	Sample Concent.	Units	Qual.	Depth to top of Sample	Depth to bottom of Sample
HDSS03-01	5756E-14	18-OCT-90	TDS (Total Dissolved Solids)	367	mg/L			
HDSS04-0	5756E-15	18-OCT-90	TDS (Total Dissolved Solids)	362	mg/L			
HDSS11-01	5756E-29	19-OCT-90	TDS (Total Dissolved Solids)	356	mg/L			
HDSS09-01	5756E-27	19-OCT-90	TDS (Total Dissolved Solids)	353	mg/L			
HDSS10-01	5756E-28	19-OCT-90	TDS (Total Dissolved Solids)	352	mg/L			
HDFDSS11-01	5756E-30	19-OCT-90	TDS (Total Dissolved Solids)	345	mg/L			
HDSS06-01	5756E-17	18-OCT-90	TDS (Total Dissolved Solids)	295	mg/L			
HDSS08-01	5756E-26	19-OCT-90	TDS (Total Dissolved Solids)	292	mg/L			
HDSS05-01	5756E-16	18-OCT-90	TDS (Total Dissolved Solids)	290	mg/L			
HDSS07-01	5756E-18	18-OCT-90	TDS (Total Dissolved Solids)	249	mg/L			
HDSS01-01	5756E-04	17-OCT-90	TDS (Total Dissolved Solids)	88	mg/L			
HDSS07-01	5756E-18	18-OCT-90	TKN (Total Kjeldahl Nitrogen)	1.5	mg/L			
HDSS08-01	5756E-26	19-OCT-90	TKN (Total Kjeldahl Nitrogen)	1.20	mg/L			
HDSS06-01	5756E-17	18-OCT-90	TKN (Total Kjeldahl Nitrogen)	0.78	mg/L			
HDSS05-01	5756E-16	18-OCT-90	TKN (Total Kjeldahl Nitrogen)	0.68	mg/L	J		
HDSS01-01	5756E-04	17-OCT-90	TKN (Total Kjeldahl Nitrogen)	0.60	mg/L	J		
HDSS12-01	5756E-31	19-OCT-90	TKN (Total Kjeldahl Nitrogen)	0.60	mg/L	J		
HDSS10-01	5756E-28	19-OCT-90	TKN (Total Kjeldahl Nitrogen)	0.54	mg/L	J		
HDSS09-01	5756E-27	19-OCT-90	TKN (Total Kjeldahl Nitrogen)	0.52	mg/L	J		
HDSS03-01	5756E-14	18-OCT-90	TKN (Total Kjeldahl Nitrogen)	0.42	mg/L	J		
HDSS11-01	5756E-29	19-OCT-90	TKN (Total Kjeldahl Nitrogen)	0.42	mg/L	J		
HDSS04-0	5756E-15	18-OCT-90	TKN (Total Kjeldahl Nitrogen)	0.42	mg/L	J		
HDSS02-01	5756E-08	18-OCT-90	TKN (Total Kjeldahl Nitrogen)	0.38	mg/L	J		
HDFDSS11-01	5756E-30	19-OCT-90	TKN (Total Kjeldahl Nitrogen)	0.38	mg/L	J		
HDFDSS01	5756E-06	17-OCT-90	TKN (Total Kjeldahl Nitrogen)	0.20	mg/L	J		
HDSS07-01	5756E-18	18-OCT-90	TP (Total Phosphorus)	0.08	mg/L	J		
HDSS05-01	5756E-16	18-OCT-90	TP (Total Phosphorus)	0.07	mg/L	J		
HDSS06-01	5756E-17	18-OCT-90	TP (Total Phosphorus)	0.06	mg/L	J		
HDSS01-01	5756E-04	17-OCT-90	TP (Total Phosphorus)	0.04	mg/L	J		
HDSS08-01	5756E-26	19-OCT-90	TP (Total Phosphorus)	0.04	mg/L	J		
HDSS04-0	5756E-15	18-OCT-90	TP (Total Phosphorus)	0.03	mg/L	J		

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Field Sample Number	EPA Sample Number	Sample Date	Chemical Name	Sample Concent.	Units	Qual.	Depth to top of Sample	Depth to bottom of Sample
HDSS12-01	5756E-31	19-OCT-90	TP (Total Phosphorus)	0.02	mg/L	J		
HDFDSS11-01	5756E-30	19-OCT-90	TP (Total Phosphorus)	0.02	mg/L	J		
HDFDSS01	5756E-06	17-OCT-90	TP (Total Phosphorus)	0.02	mg/L	J		
HDSS09-01	5756E-27	19-OCT-90	TP (Total Phosphorus)	0.02	mg/L	J		
HDSS10-01	5756E-28	19-OCT-90	TP (Total Phosphorus)	0.02	mg/L	J		
HDSS11-01	5756E-29	19-OCT-90	TP (Total Phosphorus)	0.02	mg/L	J		
HDSS02-01	5756E-08	18-OCT-90	TP (Total Phosphorus)	0.02	mg/L	J		
HDSS03-01	5756E-14	18-OCT-90	TP (Total Phosphorus)	0.02	mg/L	J		
HDSS07-01	5756E-18	18-OCT-90	TSS (Total Suspended Solids)	10	mg/L			
HDSS01-01	5756E-04	17-OCT-90	TSS (Total Suspended Solids)	6	mg/L			
HDFDSS01	5756E-06	17-OCT-90	TSS (Total Suspended Solids)	2	mg/L			

FRIDAY MAY 3, 1991 10:37 AM CENTRAL TIME
ELAPSED: 0 00:01:41.81 CPU: 0:00:35.97 BUFIO: 6 DIRIO: 912 FAULTS: 1216